VOLUME XXVIII

NUMBER SIX

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DECEMBER, 1915

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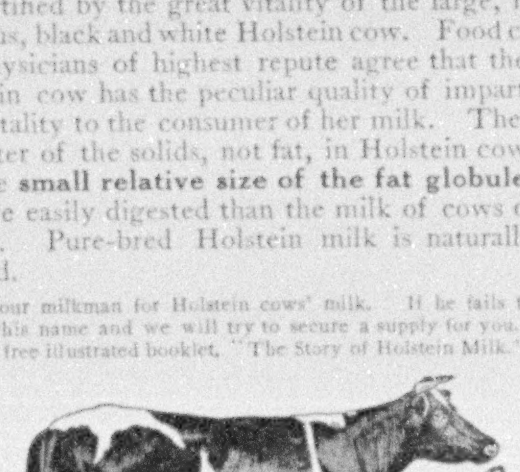

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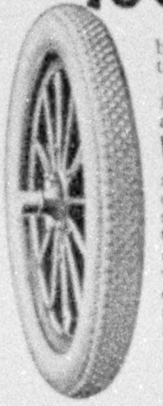

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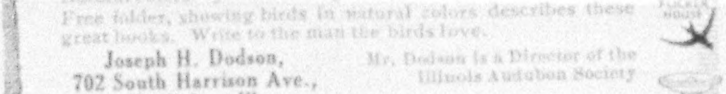

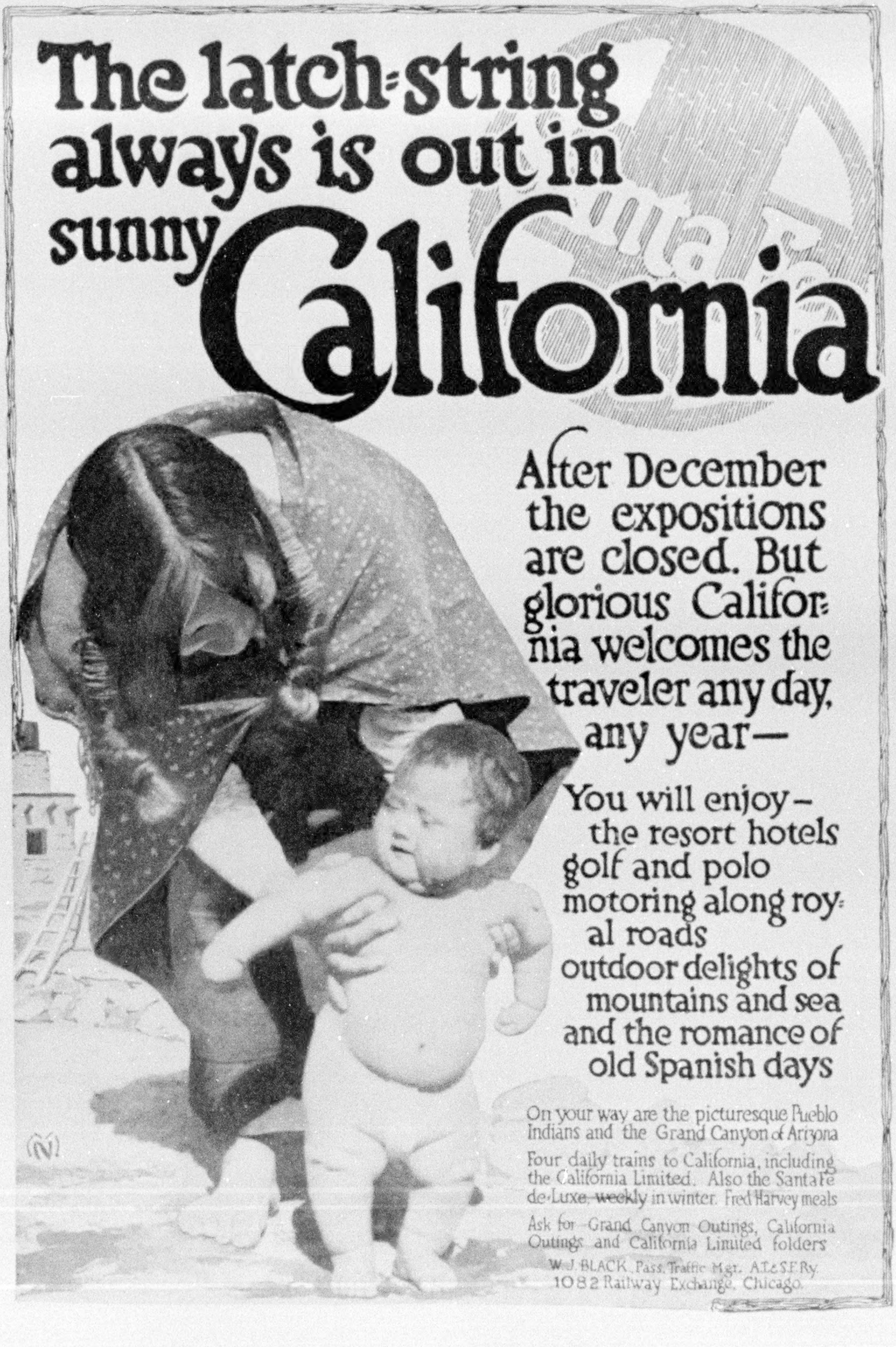
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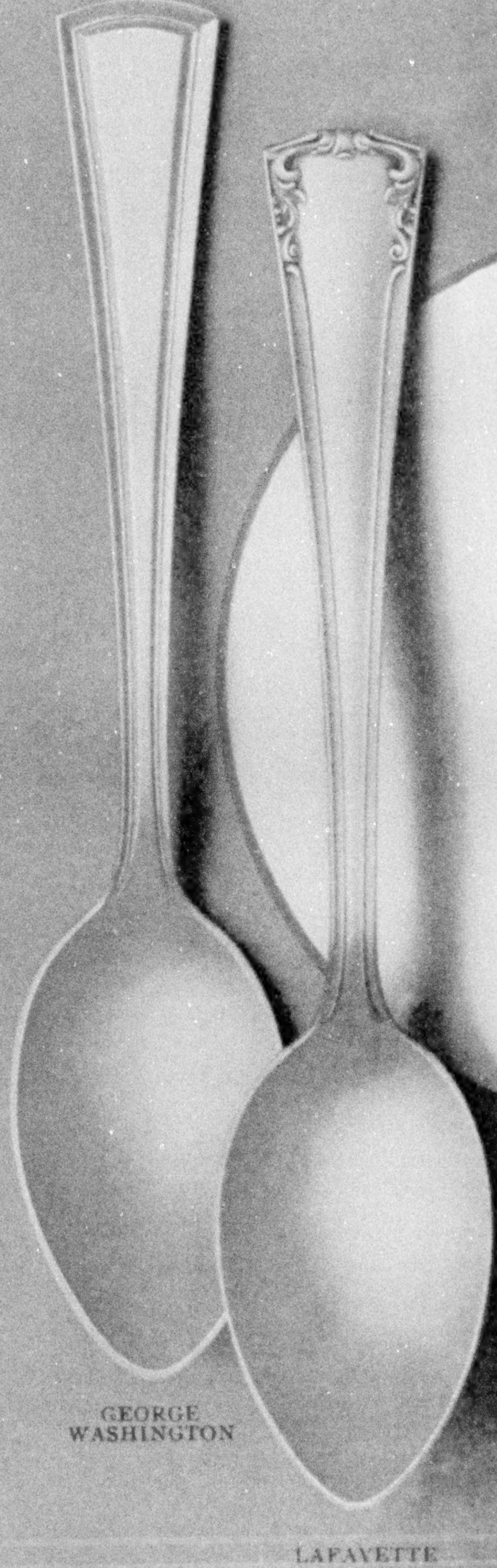

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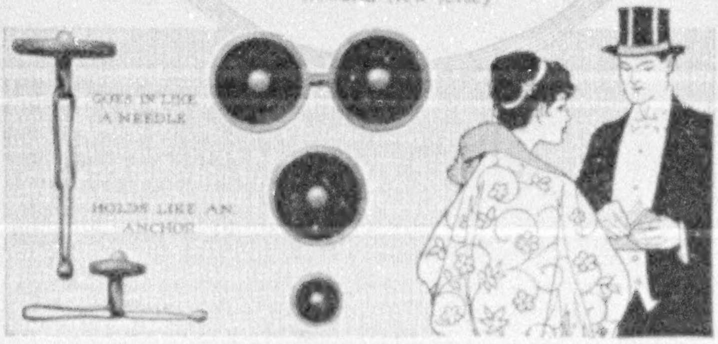

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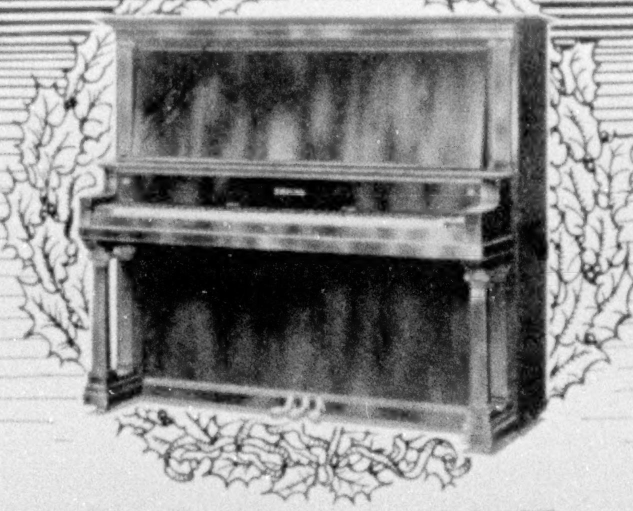

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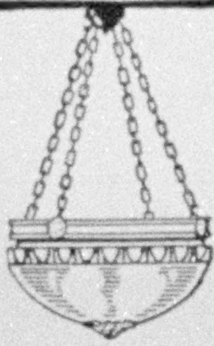

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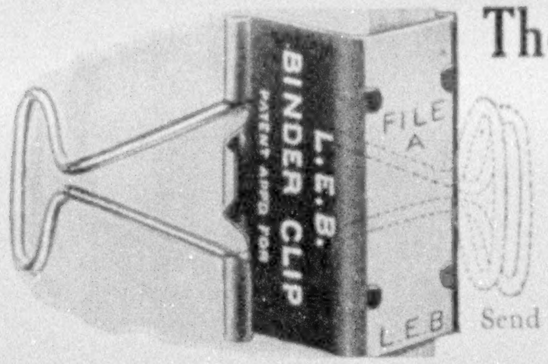

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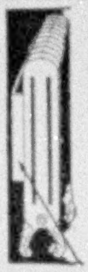

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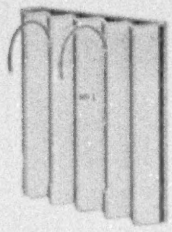

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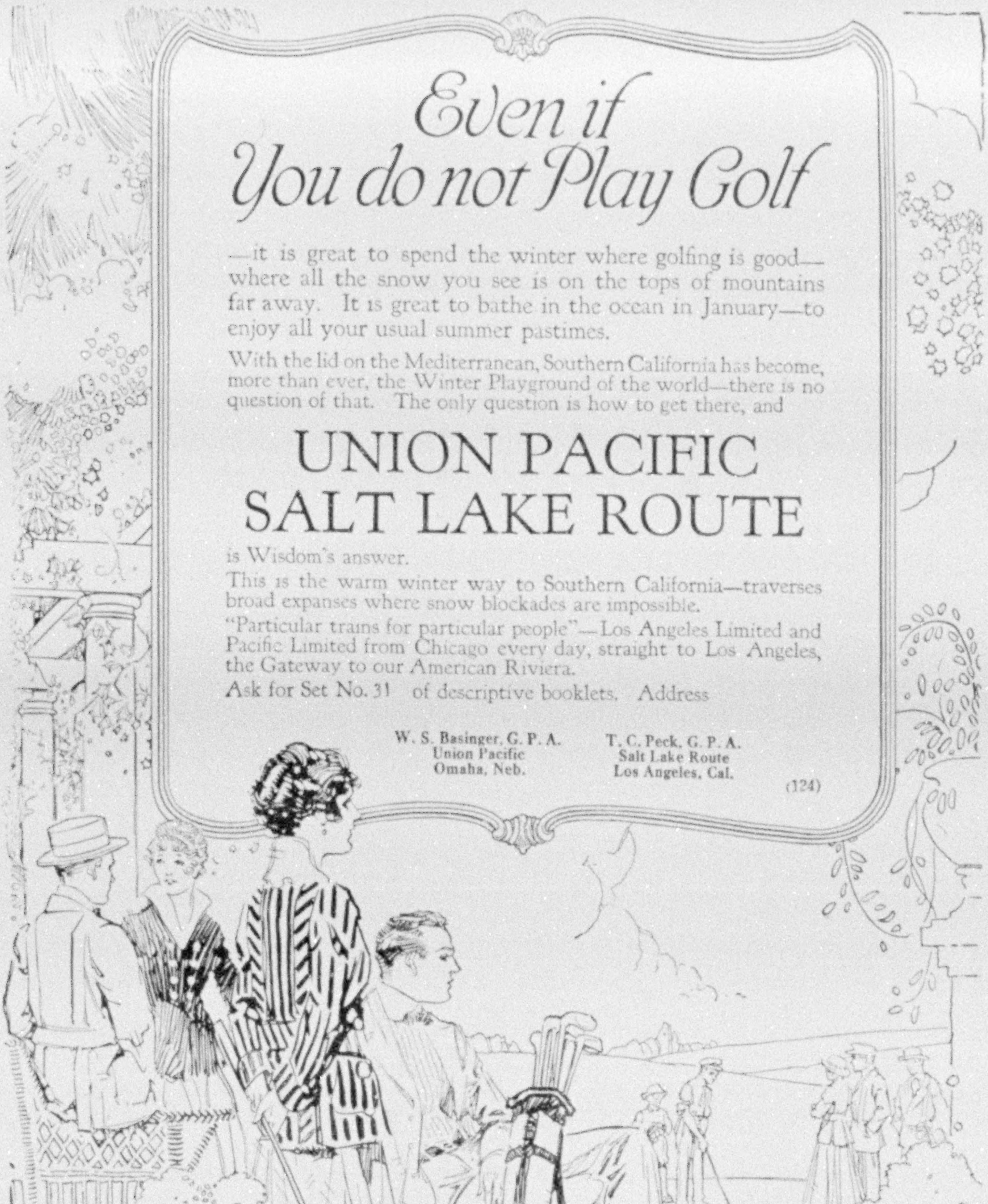
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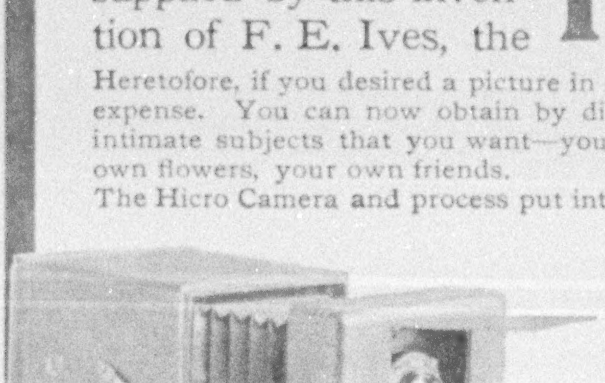

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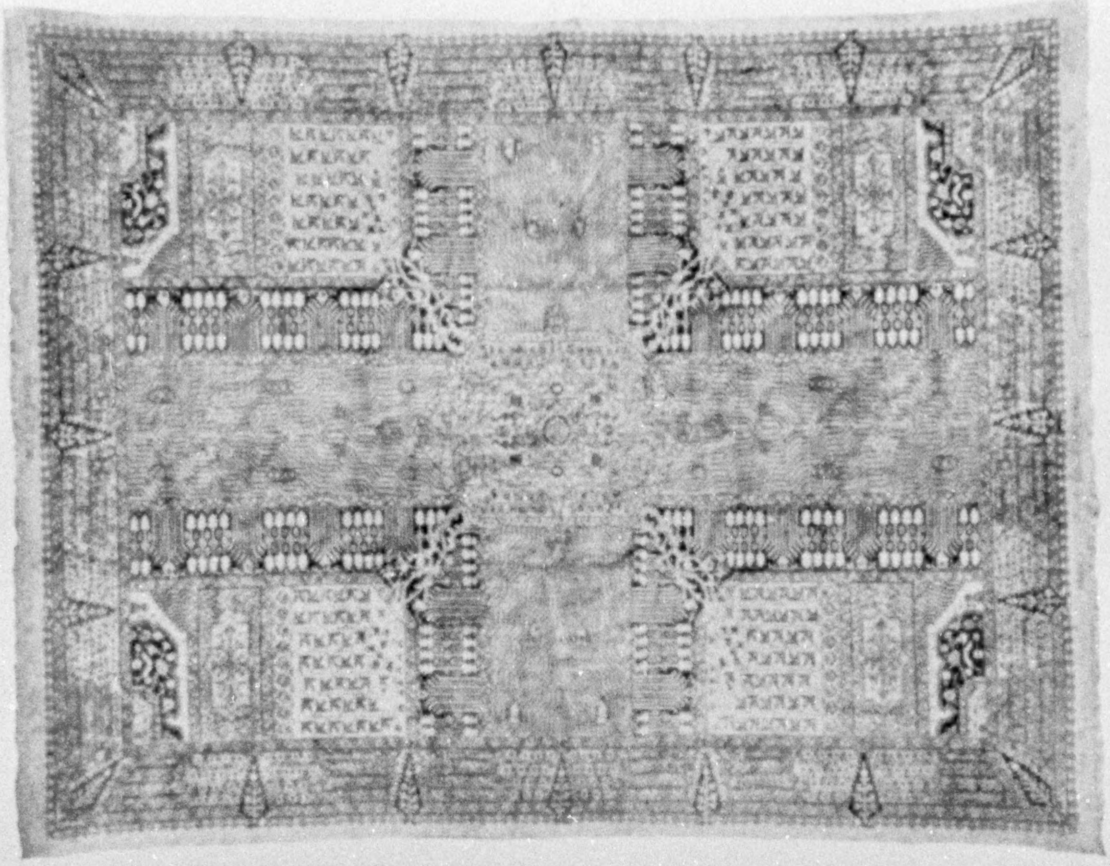

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VOL. XXVIII, No. 6 WASHINGTON DECEMBER, 1915

THE NATIONAL GEOGRAPHIC MAGAZINE

JERUSALEM'S LOCUST PLAGUE

Being a Description of the Recent Locust Influx into Palestine, and Comparing Same with Ancient Locust Invasions as Narrated in the Old World's History Book, the Bible

BY JOHN D. WHITING

AUTHOR OF "FROM JERUSALEM TO ALEPPO" AND "VILLAGE LIFE IN THE HOLY LAND," IN THE NATIONAL GEOGRAPHIC MAGAZINE

HEAR ye this, ye elders, and give ear, all ye inhabitants of the land,—hath this ever happened in your days? or in the days of your fathers? Concerning it to your children tell ye the story,—and your children to their children, and their children to the generation following:—That which was left by the creeping locust hath the swarming locust eaten, and that which was left by the swarming locust hath the grass locust eaten; and that which was left by the grass locust hath the corn locust eaten. Awake . . . and weep and howl . . . For a nation hath come up over my land, bold and without number" (Joel 1:2-6).*

Thus Joel, writing some seven or eight hundred years B. C., begins his description of a locust plague, which then as now must have laid waste this land. We marvel how this ancient writer could have given so graphic and true a description of a devastation caused by locusts in so condensed a form.

* From the Emphasised Bible, critically translated by Rotherham.

FORMER LOCUST INVASIONS

One often finds among the old peasant men those who are gifted with telling stories, whether true or imaginary, and thus, as in Joel's days, history is still handed down to the children, children's children, and another generation. The oldest men have thus been recounting the stories of havoc caused by flying locusts fifty years ago that used to sound like "Arabian Nights" tales. Still there is no doubt that the present visitation eclipses any in the memory of the present generation, and probably equals in severity any former one.

Since 1865, so commonly called "sent el jarad" (year of the locusts), locusts have at intervals reappeared in Syria, but in smaller areas and causing nothing like a general disaster or distress, the more recent of these having occurred in 1892, in the Jordan Valley near Jericho, where waving fields of tall green barley and wheat were eaten down to the very stump in a remarkably short time. In 1899 they were found in small quantities in Galilee,

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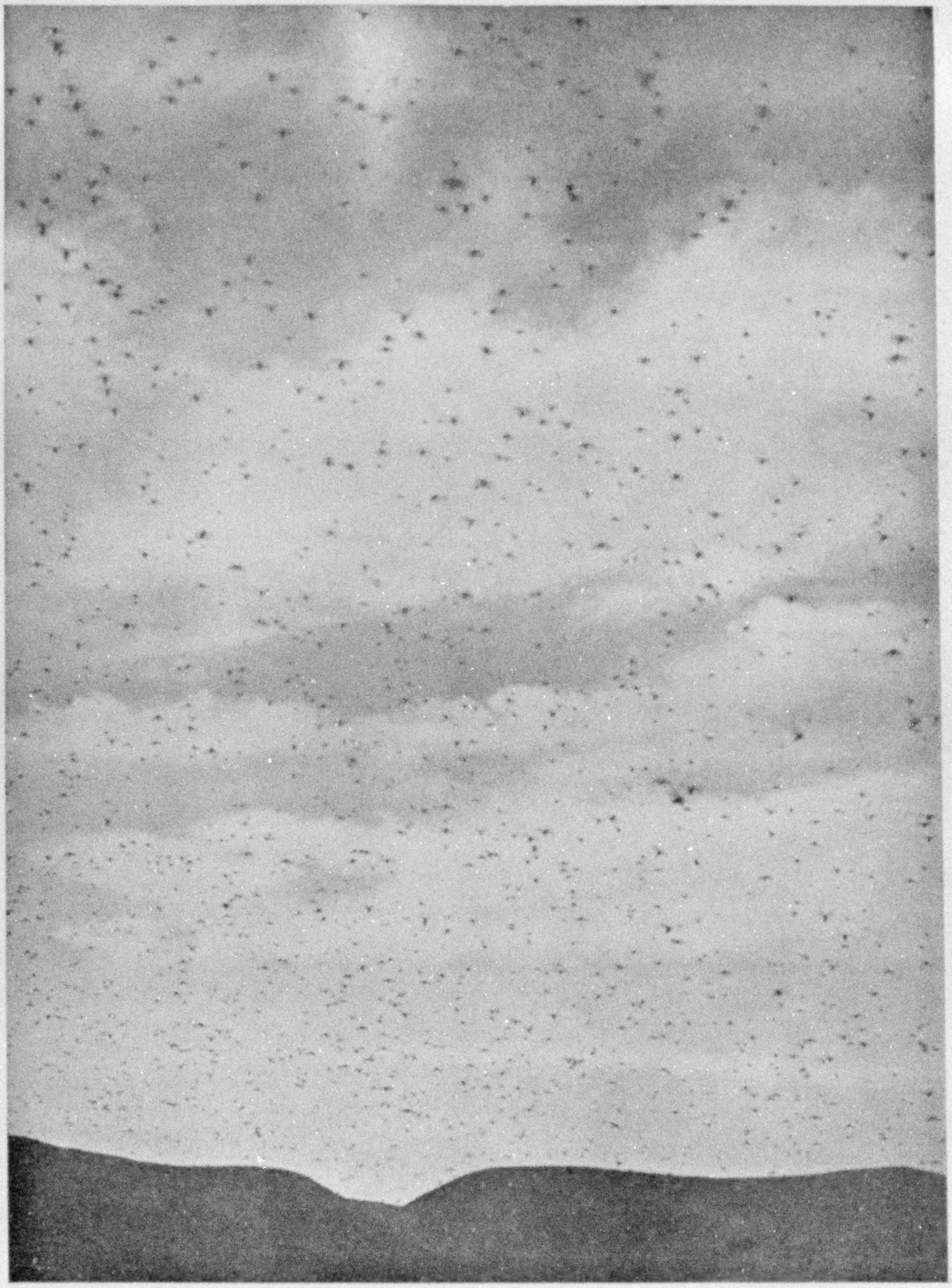

Photo by American Colony Photographers, Jerusalem

THE FIRST APPEARANCE OF THE LOCUSTS

"Attention was drawn to them by the sudden darkening of the bright sunshine, and then by a veritable shower of their excretions, which fell thick and fast and resembled those of mice, especially noticeable on the white macadam roads. At times their elevation was in the hundreds of feet; at other times they came down quite low, detached members alighting" (see text, page 513).

and in 1904 in the southern desert, also visiting Egypt.

The present influx covered all of Palestine and Syria—that is, from the borders of Egypt to the Taurus Mountains.

ADULT FLIERS FIRST APPEAR

It was one of the last days of February, 1915, that Mr. Lewis Larson, to whose skill and energy we are indebted for the superb collection of locust pictures appearing on these pages, returned from the picturesque Ain Fara gorge, which borders on the Wilderness of Judea and is only a few miles east of Jerusalem, with word that swarms of locusts had flown overhead in such thick clouds as to obscure the sun for the time being.

However, before they were seen, a loud noise, produced by the flapping of myriads of locust wings, was heard, described as resembling the distant rumble of waves, or, as St. John has it, "the sound of their wings was as the sound of chariots of many horses running into battle" (Rev. 9:9),* the picture on page 512 vividly portraying Joel's word picture

> "A day of cloud and thick darkness,
> As dusk spread over the mountains—
> A people many and bold" (Joel 2:2).*

Immediately rumors poured in from the Christian towns of Es Salt, on the uplands east of the Jordan, and Bethlehem, that similar swarms had also visited them, causing much destruction.

In Jerusalem the first were seen one Monday of the first days of March, at noon. Attention was drawn to them by the sudden darkening of the bright sunshine, and then by a veritable shower of their excretions, which fell thick and fast and resembled those of mice, especially noticeable on the white macadam roads. At times their elevation was in the hundreds of feet; at other times they came down quite low, detached members alighting. The clouds of them would be so dense as to appear quite black, with the edges vignetted till they thinned down and faded away into the clear blue sky around.

For several days Jerusalem was thus visited. Predictions were rampant as to the terrible results which would accrue, but now we can see that not even the worst pictured the actual ravages as severe as we now see them. They did not settle in Jerusalem, evidently seeking greener and less populated districts; so that after the first few days nothing more was seen of these adults here, while at Bethlehem they were brought to the earth by heavy showers of the late rains.

Quantities were now gathered by the poorer Bethlehemites. A few ate them roasted, describing the taste as delicious, especially the females full of eggs. Still the main reason for collecting them was in order to secure the small bonus offered by the local government of Bethlehem. Thus tons were destroyed, being buried alive till several ancient abandoned cisterns were filled, while in surrounding villages each family was required to produce a stipulated weight. Likewise in Jaffa they were destroyed by being thrown into the Mediterranean and, when washed ashore dead and dried on the beach, were collected and used as fuel in the public "Turkish baths" and ovens.

FROM WHENCE COME THE LOCUSTS?

These clouds of flying locusts, in Jerusalem at least, invariably came from the northeast going toward the southwest, and it was observed that when strong winds arose, too stiff for them to resist, rather than be carried they seemed to settle till the storm passed over.

Students of Joel, who assert that the first two chapters up to the 28th verse picture an actual invasion of locusts and not Judah's human enemies, as the Assyrians and Chaldeans, find a difficulty in the verse, "And the northerner will I remove far from you," since locusts were reported to invade Palestine from the south; the present experience not only removes this difficulty but establishes the accuracy of Joel's account.*

As to the exact region from which they migrated to visit Palestine, it is now difficult to say, especially in view of the disorganization of mails and news channels caused by the present cruel European war.

* The Emphasised Bible, Rotherham.

* Cambridge Bible, Driver, Joel, and Amos, page 28.

Photo by American Colony Photographers, Jerusalem

NATURAL ENEMIES OF LOCUSTS

"Large flocks of storks flew past Jerusalem during the early days when the adults arrived and after the larvæ were hatched, consuming abnormal quantities, for which reason the natives have always given 'Abo Saad' a warm welcome" (see text, page 521)

THE WALLS OF JERUSALEM

"During the Egyptian plagues we find Moses announcing the locust scourge in terms of which our present experience is such an exact duplicate, as follows: 'Behold tomorrow will I bring the locusts into thy coasts: and they shall cover the face of the earth . . . and they shall eat the residue of that which is escaped . . . every green tree which groweth. . . . And they shall fill thy houses, and the houses of thy servants, and the houses of all the Egyptians'" (Ex. 10: 4-6) (see text, page 533).

With these adult locusts, the *Acridium peregrinum,* more commonly termed *Schistocerca peregrina,* the males and females are readily distinguished, for, like most creatures, human beings excepted, the males are by far the handsomer. Both are about 2½ inches long, the female being slightly larger. The wings are semi-transparent and filled with veins, or, more correctly, strengthening tissues, and are white with brown spots. The male has a vivid yellow body, while that of the female is a deep brown.

LAYING THE EGGS AND DYING

At once these numberless hosts began to prepare for the destruction that was to follow. Each female, now loaded with eggs, seeks a place suitable to deposit them, and with her ovipositors is able to sink a hole as much as 4 inches deep, through hard compact soil, such as would try the strength of human muscles even with iron tools (see also page 521). How so small and frail a creature can bore in such hard ground and to such a depth seems a marvel which only nature can accomplish or explain. While boring the hole the female sits, wings outstretched, upon the earth, and possibly moistens the soil to facilitate the work. She evidently has the ability to stretch or lengthen her *annulea,* pressing her body into the hole till the depth required is attained.

The eggs, averaging about a hundred in number, are now deposited in the bottom of this hole, not haphazard, but neatly arranged in a long cylindrical mass and enveloped in a sticky glutinous secretion, with which frothy substance the top of the hole is also sealed to prevent enemies encroaching, and at the same time of such a nature as to allow the newly hatched brood to get out readily. It was found, in digging for these eggs, that when newly laid they could with ease be removed from the soil in one piece over an inch long and as thick as a slate pencil; but once a few days had passed, they crumbled apart when touched.

The eggs require a certain amount of moisture, for once dried or exposed to air they never hatch, which no doubt accounts for the depth to which the mother parent at times deposits them into the ground.

Once the female locust has laid the eggs, her life mission is done; she flies away—where to one cannot say—and soon dies.

One remarkable feature is the variety of soils and climatic conditions under which these eggs were laid. In the Jordan Valley, earth's lowest spot, 1,300 feet below the Mediterranean, we find them deposited on the very banks of this historic river, notably at "the Ford," where it is supposed the Children of Israel passed over into Canaan (Josh. 3); also farther down toward the Dead Sea, in soil heavily impregnated with alkali, where are the "slime pits" into which probably, during their retreat, the kings of Sodom and Gomorrah fell when in full flight from Chedorlaomer and his allies (Gen. 14).

Then they were to be found on the highest mountain tops; in the beautiful olive groves about Bethlehem and Zelzah, birthplaces of David and Saul, Israel's first kings; also in the vicinity about the fields and village of the Shepherds, where, eighteen hundred years ago, mortal ears heard an angel chorus; in the chalky soil of Wad el Nar (Valley of Fire), which is the extension of the Vale of Hinnom, a place where Israel caused "his son or his daughter to pass through the fire to Molech" (2 Kings 23:10).

They were deposited in the barren districts of the wilderness of the "scape goat" (Lev. 16:7-26), as well as in the richest soil of the Philistine Plain, where Samson turned loose the 300 foxes with firebrands into his enemies' wheat fields (Judges 15:4, 5); also in the soft, moving sand-dunes along the seacoast of Tyre, Sidon, Askelon, and Gaza, cities once ranking with the greatest of the earth; among the world-famed Jaffa orange orchards; in the rocky and rugged valley between Mickmash and Gibeah, on whose precipitous sides "Jonathan climbed up on his hands and his feet" into the Philistine garrison and slew a score of them (1 Sam. 14:4-14). In fact, in all parts of the country so laden with historic events, whether in open fields or standing grain, in the plain or in

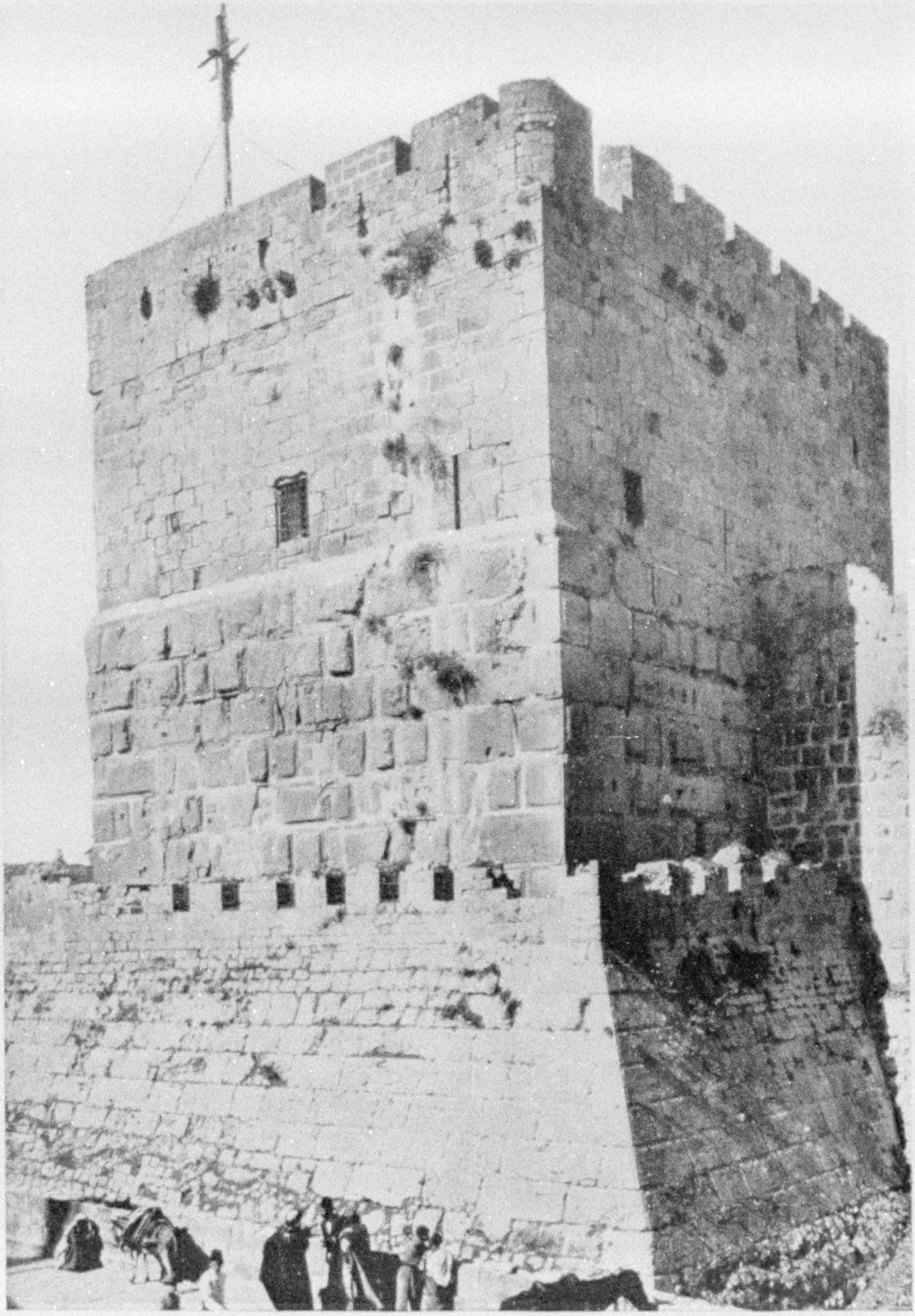

Photo by American Colony Photographers, Jerusalem

THE TOWER OF DAVID

"Did not Joel then see the already ancient walls of Jerusalem in his day, as we do now, form so slender an obstacle to tiny soldiers composing immense armies, causing him to so graphically exclaim: 'They shall run like mighty men; they shall climb *the wall* like men of war; and they shall march every one on his ways, and they shall not break their ranks!'" (Joel 2:7) (see text, page 526).

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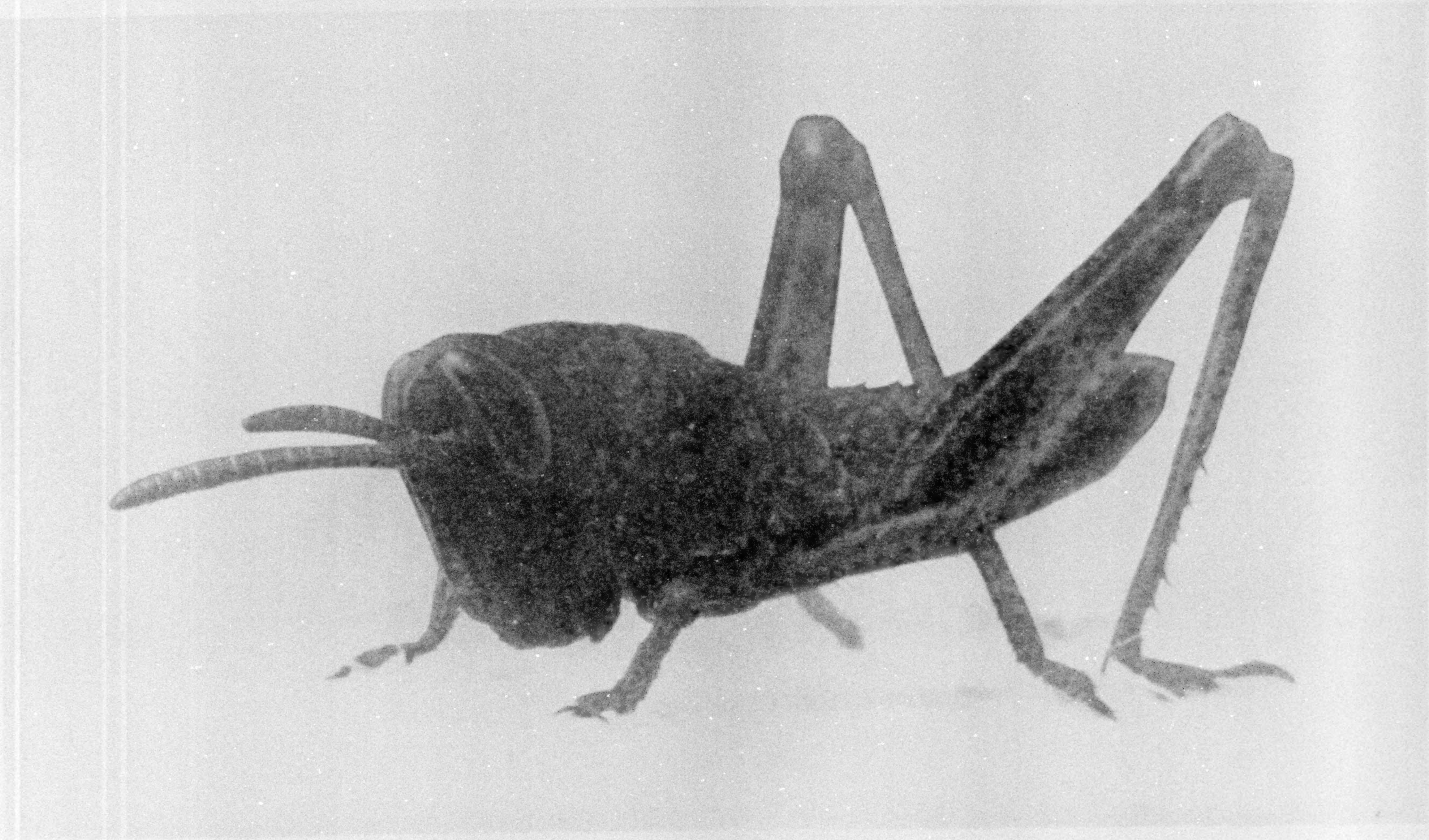


Photo by David Fairchild

A YOUNG LOCUST IN THE LARVA STAGE, BEFORE IT HAS ANY SIGNS OF WINGS (SEE TEXT, PAGE 543)

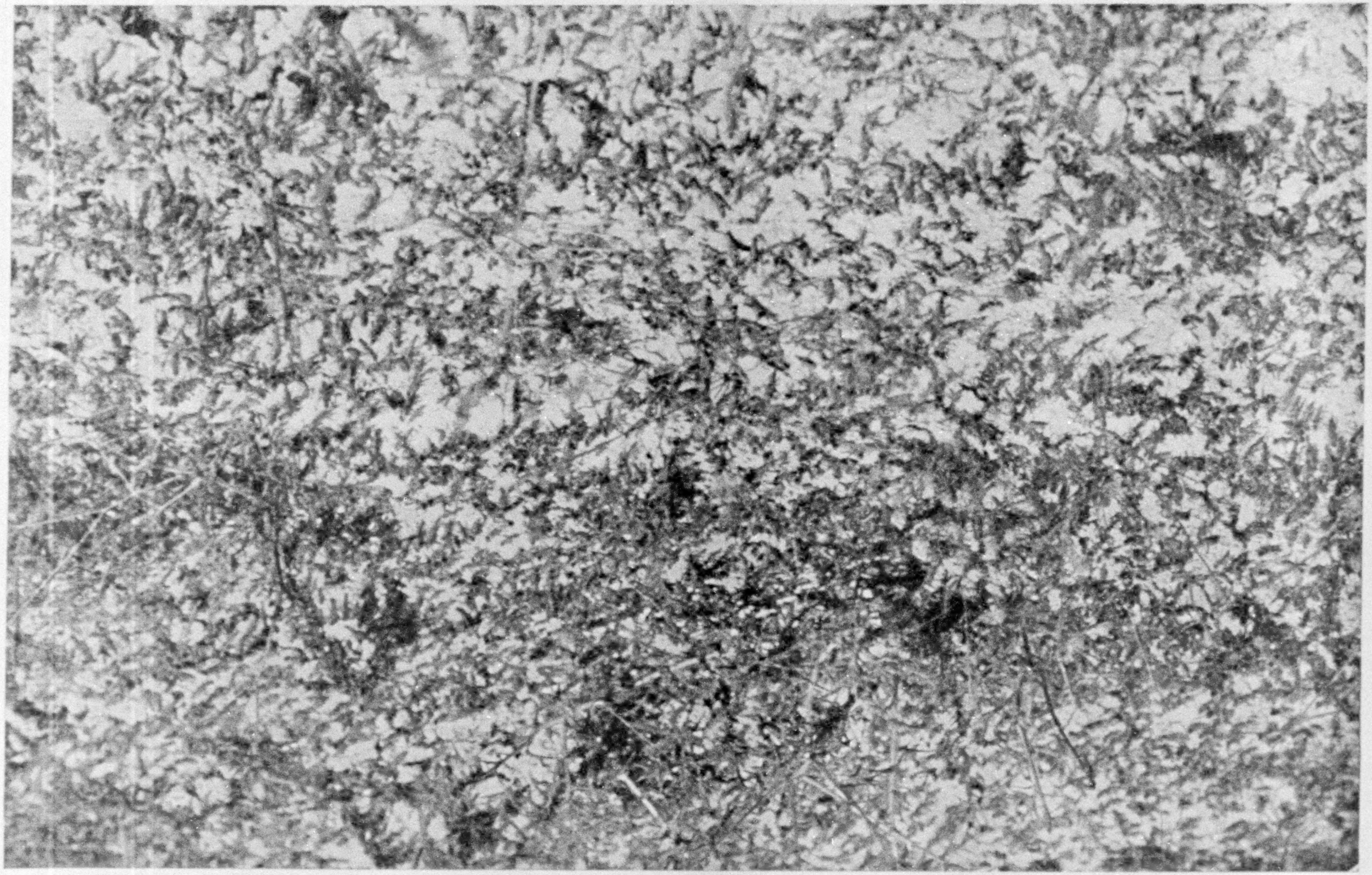


Photo by American Colony Photographers, Jerusalem

THE LOCUST LARVA AS FIRST SEEN NEAR JERUSALEM (SEE PRECEDING ILLUSTRATION)

"No wonder then, that the writer of the book of Judges likens the hordes of the Midianites, who for years devastated Israel's land, to locusts, and 'as the sand which is upon the sea-shore for multitude'" (Judges 7:12) (see text, page 522)

Photo by American Colony Photographers, Jerusalem

A VINEYARD STRIPPED BY LOCUSTS OF ALL ITS LEAVES

"Once entering a 'vineyard,' the sprawling vines would in the shortest time be nothing but bare bark, the long, dark stems lying flat on the ground much resembling snakes" (see text, page 529). Note how even some of the shoots have been barked, leaving them snow-white.

the sterile and rocky mountains, whether it be damp grounds or those absolutely parched and dry, there seemed to be little difference.

While going to the Samaritan Passover we* observed in the valleys we passed between Bethel and Mount Gerizim swarms of the adult locusts flying about. At Zahtara the entire mountain side, a rocky slope facing south, with sparse wheat patches between the boulders, was simply covered with locusts preparatory to laying eggs. On the homeward trip the next day they were still there, and while climbing a short-cut on foot we each trod to death several hundreds, so thick were they. Five days later, returning for the ceremony on the last day of the Passover, not a trace of one was to be found.

COLLECTING THE LOCUST EGGS

Once the alarming extent to which these eggs were laid was realized, the authorities issued a proclamation, dated April 19, requiring each male person from 16 years to 60 to gather eleven pounds of the eggs.

To be among the first to set a good example, the young men of the American colony at once began the work of collecting; for so steeped are the natives in fatalism (Allah has sent the "jarad" and they are helpless to fight them) that, unless forced or shown how to, few would turn a finger over in self-defense. The fields chosen for our work were those last mentioned about "Gabah" (Gibeah), now a poor village, possibly the very Gibeah whose inhabitants were once the cause of the first Israelitish civil war, in which the tribe of Benjamin all but perished (Judges 20).

As we started out, loaded with small knapsacks of food and blankets, and armed with small picks, the clouds gathered and the winds blew. It was so late in the year that hard rains had not been anticipated; but when the party got to Ain Farah, where headquarters were to be established with "Abid el Waleh," a character few who have been to Ain Farah do not know, sleeping outdoors had to be abandoned because of the downpour.

Seemingly the only alternative was to accept the host's hospitality in his sheepfold, a large natural cave with but a small opening, of which the precipitous cliffs here are full. Such were the "sheep-cotes," by the way, at Engedi, in which the pursuing King Saul lay asleep at the mercy of his fugitive David, who even now refrained from killing his lifelong enemy, but, instead, only "cut off the skirt of Saul's robe" (1 Samuel 24).

But not relishing the enjoyment of passing the night in a flea-infested cave, the like of which kings in the past had not despised, Yankee ingenuity constructed instead a small roof out of a few sheets of corrugated iron, which were Abid el Waleh's share of booty from a recent pillage, and although the rain beat down relentlessly, it afforded some little protection. After two such nights and rainy days the party returned home with but a handful of eggs; but, better still, with fields for future egg hunting well located.

The storm once over, a little tent afforded protection for the second campaign. Most of the locust eggs we discovered were in uncultivated fields of the hardest dark-red soil, covered with a thin sod. A small patch would be found only a few meters in extent literally honeycombed and filled with the eggs; then for a space no more would be found till a new spot was located. A warm, sunny place with a southern exposure seemed to be the rule.

It is estimated by competent authorities that as many as 65,000 to 75,000 locust eggs are concentrated in a square meter of soil, and allowing for a loss of 30 per cent in hatching, some 60,000 destroyers can emerge from a space 39 inches square (see also page 516).

NATURAL ENEMIES OF LOCUSTS

Locusts are not, however, without their own enemies provided by nature. Large flocks of storks flew past Jerusalem during the early days when the adults arrived and after the larvæ were hatched, consuming abnormal quantities, for which

*The party mentioned were the three responsible for the present article—Mr. Lewis Larson, photographer; Mr. Lars Lind, and the author.

reason the natives have always given "Abo Saad"* a warm welcome (see page 514).

While collecting these eggs many of the cells were found to contain eggs laid by certain species of flies, probably the *Ida lumata* Fabr. and the *Anthomya cana* Macq., the young worm or larva of which, when hatched, lives upon the locust eggs, sucking them dry, till developed into the chrysalis and emerging a full-fledged fly. Wild birds and domestic fowls developed a ravenous appetite for locusts, while with the smaller larvæ and pupæ turkeys and chickens simply gorged themselves, with the result that the yolk of their eggs became a deep-red color.

At breakfast one morning Allie brought on a most gorgeously tinted omelet, when little Spafford, fixing his astonished eyes on it and hearing that the chickens feeding on locusts were responsible for the change in color, broke out with "Mama, if we hatched those eggs, would locusts come out with the chicks?"

But while countless numbers thus fall prey to the appetites of tiny worms or these larger birds, it is said that the locust is its own worst enemy, as later we shall see (pages 544 and 547).

A TRICK IN EVERY TRADE

Of late the city natives have revived an old dish called "ishareyeh," a sort of macaroni rolled by hand from dough into small particles which exactly resemble locust eggs. While many forms of evading the law were sought, one of the trickiest ways was by a certain Jerusalemite who, not wishing to exert himself in collecting the locust eggs, shirked the burden in true Oriental style onto his wife. She, procuring some white clay, rolled it like "ishareyeh" into forms so like the locust eggs that, when presented to the officer in charge, they readily passed for the genuine article. She, of course, could not keep the secret; it was too good to keep, and that is how it is now known.

THE CREEPERS REACH JERUSALEM

Scarcely had Jerusalem gotten over the excitement of the search for eggs, scarcely had they relapsed into a sense of something like safety from disaster as a result of those efforts, than word poured in that first the lowlands, or Plain of Sharon, and then the hill country to the west of the city, were teeming with the young larvæ.

At Jerusalem proper no eggs had been laid, as above noted, the nearest fields being in the Valley of the Roses, out of which the railroad emerges on approaching Jerusalem. From here, then, and from the Bethlehem district came the forces to attack the "Holy City."

When first hatched they were quite black and resembled large ants, having no signs of wings; but as they developed, passing through one stage and into another, they cast their little outer skins, now no longer large enough to contain the growing body. Thus they pass through several moults, of which, however, but three stages are plainly distinguishable—the larva or wingless stage (see page 518), the pupa, with small wings, or properly wing sacks developing (see pages 536 and 543), and the full-fledged flying locust (see page 538).

Once hatched the little fellows seemed to hold together for a few days, till a little developed and in sufficient numbers, when they would start their forward march of from 400 to 600 feet per day, clearing the ground of any vegetation before them.

It was observed that these new broods instinctively went in the reverse direction to that from which their flying parents had come, making practically for the northeast. None but those who have seen them can begin to imagine their countless multitudes and the destruction to follow. No wonder, then, that the writer of the book of Judges likens the hordes of the Midianites, who had for years devastated Israel's land, to locusts, and to "the sand which is upon the sea-shore for multitude" (Judges 7:12) (see page 519). "For they (Midian) came up with their cattle and their tents; they came in as locusts for multitude; both they and their camels were without number; and they came into the land to destroy it" (Judges 6:5).

*Abo Saad (Father of Good Luck), the Arabic name for the stork.

Photo by American Colony Photographers, Jerusalem

A FRESHLY ATTACKED FIG TREE

In an inconceivably short time every leaf is consumed, leaving bare and barked twigs only

Photo by American Colony Photographers, Jerusalem

A FIG TREE JUST BEFORE THE LOCUSTS ATTACKED IT (COMPARE WITH NEXT PHOTO)

LOCUSTS CAUSE SEASICKNESS

One evening it was heard that the locusts had already reached the German colony and the railroad station, and as we went out the next day to see them, scarcely had our carriage swung around from the Jaffa Gate than we found the white road was already black with them. Ever in the same direction they pushed up the "Western Hill," still commonly called Zion, even entering the houses about the "Tomb of David." The roads now became so slippery from the masses of the little, greasy bodies crushed beneath the horses' hoofs that the horses could scarcely keep a footing and had consequently to be driven slowly and with great care. Afterward it was heard

Photo by American Colony Photographers, Jerusalem

A FIG TREE JUST AFTER THE LOCUSTS ATTACKED IT (COMPARE WITH PRECEDING PHOTO) (SEE TEXT BELOW)

that likewise trains throughout the country had been stopped for hours at a time, notably on the Damascus-Haifa line near the Lake of Galilee.

Below the Lower Pool of Gihon old olive trees, yesterday green, were now nothing but bare trunks and twigs, and further up the valley a couple of beautiful mulberry trees had just been attacked, the leaves falling like rain, and already the ground was deeply strewn with them, and long before evening they, too, were leafless. This, however, proved to be but a sample of coming things.

The locusts, when advanced into the second or pupa stage, walk like ordinary insects, leaping only when frightened into a quicker pace, which they readily accomplish by the use of their two long and powerful posterior legs. However, while still in the first or larva stage, they seemed to hop much like fleas, so that when anything neared their thickened masses it seemed as if the entire surface of the ground moved, producing a most curious effect upon one's vision and causing dizziness, which in some was so severe as to produce a sensation not unlike seasickness. The same was also true when watching them undisturbed on tree or field.

SCALING THE TOWER OF DAVID

One of our most interesting experiences, while noting the locusts' methodical but stubborn moves, occurred when they first reached Jerusalem. Countless numbers of the young locusts poured into the broad, walled road leading into the city from the west, past the United States Consulate to the Jaffa Gate. For three or four days an incessant and unending stream filled the road from side to side, like numberless troops marching on parade, and in spite of the traffic at this junction, which to this city is like lower Broadway to New York, their ranks, although thinned, entered the ancient gateway and the New Breach. "Though in among the weapons they fall they shall not stop" (Joel 2:2).*

* The Emphasised Bible, Rotherham.

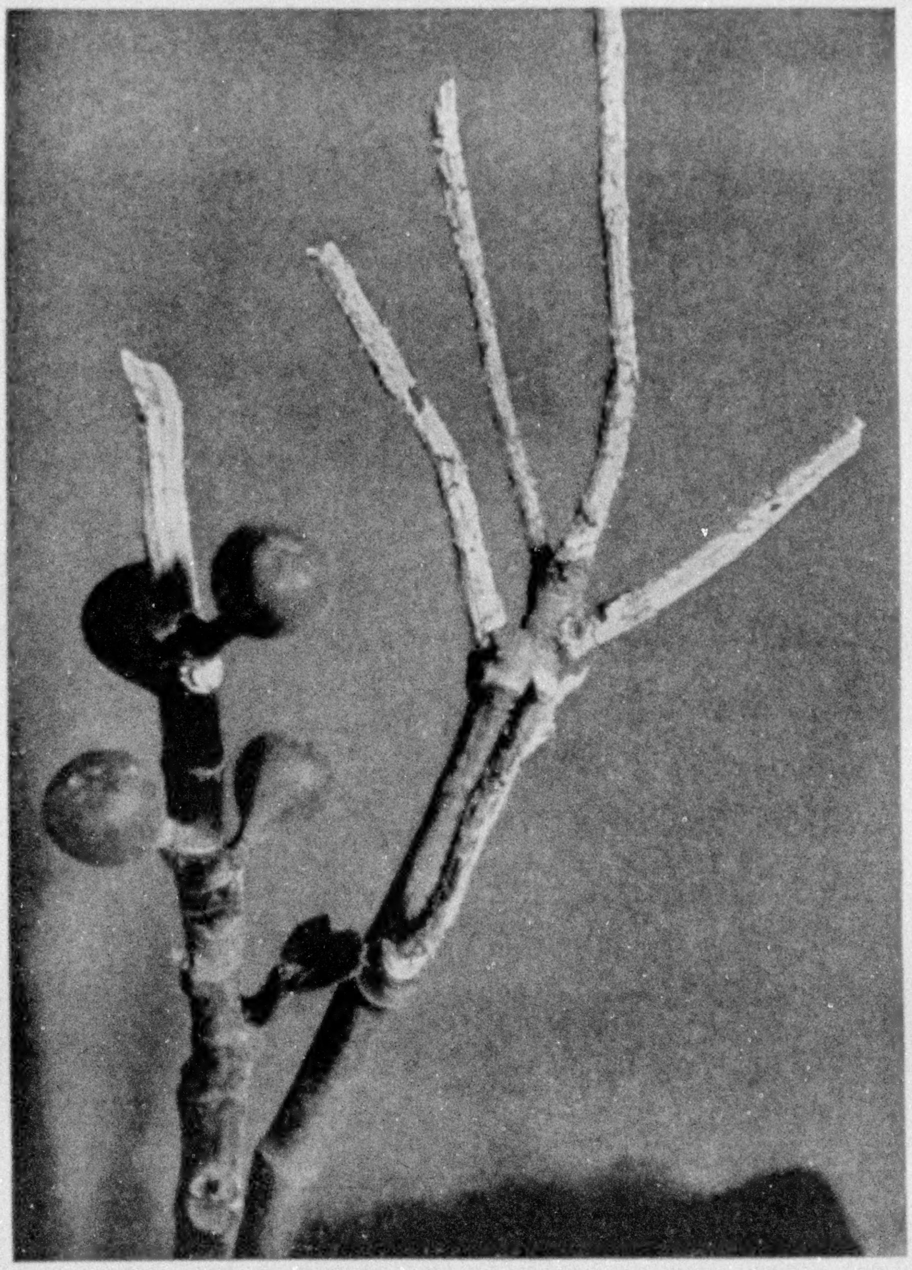


Photo by American Colony Photographers, Jerusalem

"He hath . . . barked my fig tree; he hath made it clean bare. . . . The branches thereof are made white" (Joel 1:7). This photograph was taken about two weeks after the locusts had destroyed the tree (see text, page 529).

cient walls of Jerusalem in his day, as we now do, form so slender an obstacle to tiny soldiers composing immense armies, causing him to so graphically exclaim: "They shall run like mighty men; they shall climb *the wall* like men of war; and they shall march every one on his ways, and they shall not break their ranks"? (Joel 2:7). What should have impelled them thus, against odds, to make for the old walled town; for, as all who have been here know, "Jerusalem is built as a city that is compact together" (Psalm 122:3), affording nothing in the way of forage for them? Seemingly it can only be explained by their instinct leading them in a definite direction.

After a few days' effort, however, they reversed their course, and for several days streams of them made for the opposite direction, but only far enough to escape the barrier which the city afforded; and,

Thus the moat around "David's Tower" was so filled that the dry earth seemed to be a living mass. Up and up the city walls and the castle they climbed to their very heights.

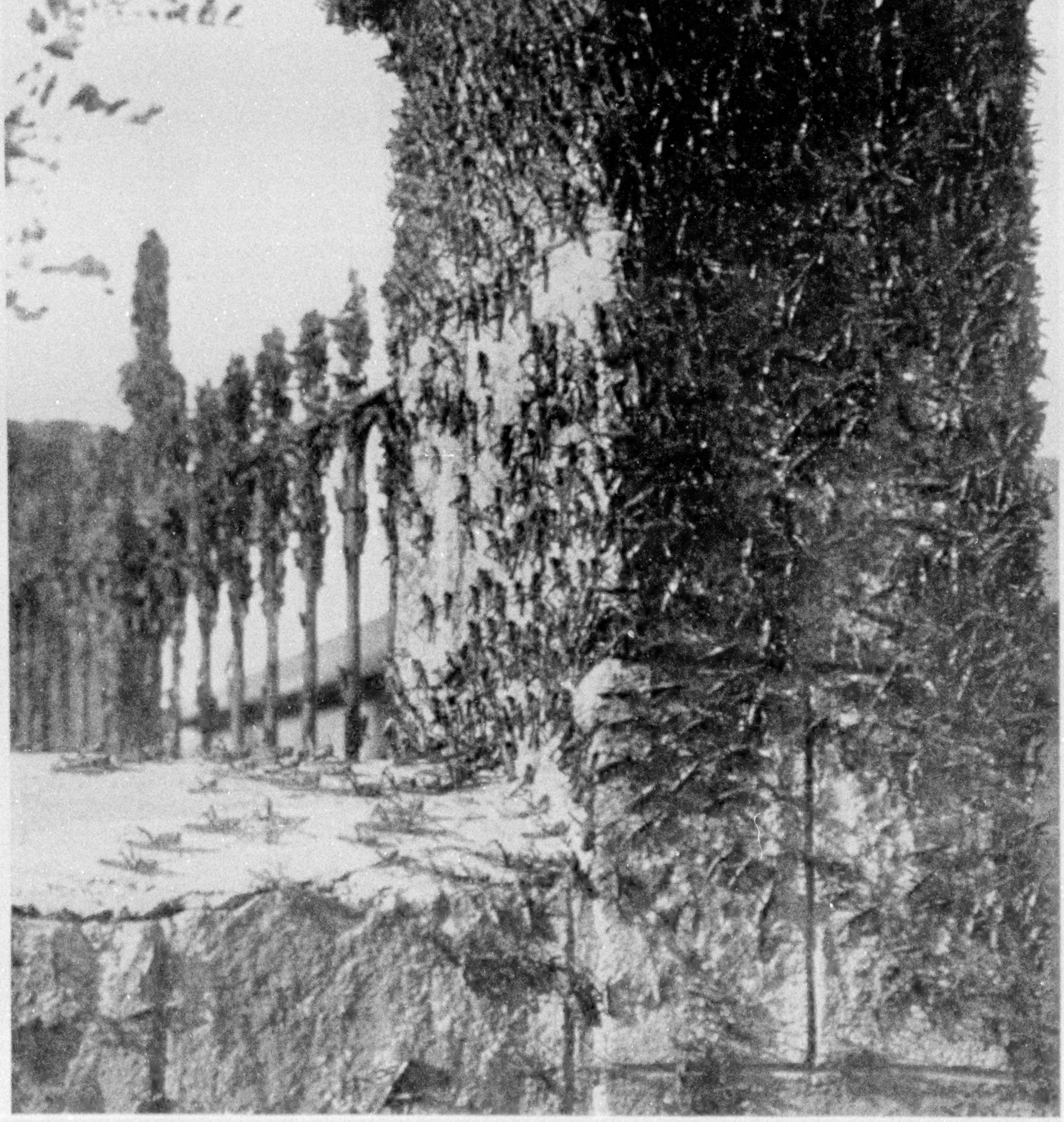
The origin of this tower, as all will infer, has been attributed to King David ever since the Middle Ages, and while it may not be the very "Castle of Zion," the foundations, and especially the site as a natural defense, must have dated back many centuries, if not to the days when Jerusalem was created an Israelitish city from the older Jebus, wrested from the Jebusites by David. The castle now affords a fine example of the ancient style of fortifications (see page 517).

Did not Joel then see the already an-

this once attained, they swung around into the very direction heretofore pursued.

Again, what could have instructed them thus to escape the difficulty? Solomon, the first naturalist, if we may thus call him, says of them: "The locust hath no king, yet go they forth all of them by bands" (Prov. 30:27).

At the consulate the fight was taken up to save the garden. It lay, as we have seen, in the main path of the locusts. The inclosure, about the size of an ordinary American city lot, required five men to keep incessantly brushing the locusts down from the walls on the three sides attacked. At the southern end, so persistent were they that but a few seconds



THE ATTACKING HOSTS

"Disastrous as they were in the country, equally obnoxious they became about the homes, crawling up thick upon the walls" (see text, page 533)

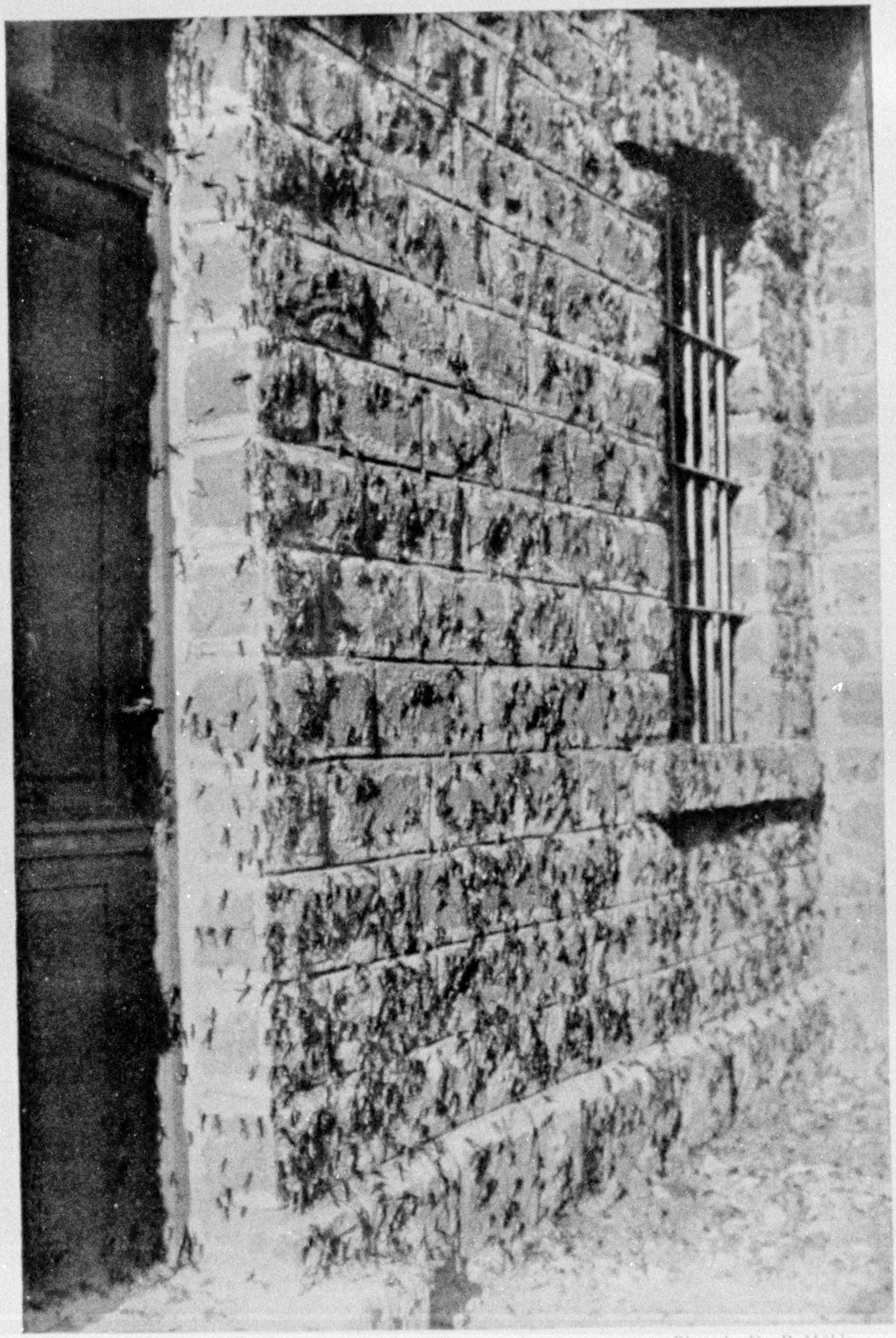


Photo by Dr. P. Mühlens

"AND THEY SHALL FILL THY HOUSES, AND THE HOUSES OF THY SERVANTS, AND THE HOUSES OF ALL THE EGYPTIANS"

Thus during the Egyptian plagues we find Moses announcing the locust scourge in terms of which our recent experience was such an exact duplicate (Exodus 10: 4-6) (see text, page 533).

after being cleaned the wall would again become a living mass.

It was the 28th of May when the larvæ, already passing into the pupa stage, reached the quiet of Gethsemane, now in its full summer bloom; but scarcely had a day passed before every tender thing was consumed, and even the leaves of the woody cypress and of the olive trees, the latter about 1,000 years old, were threatened. "The land is as the garden of Eden before them, and behind them a desolate wilderness; yea, and nothing shall escape them" (Joel 2:3).

But now, after passing up this narrow defile between the city and Olivet, and to the west of the city, making through the more sparsely built new Jerusalem, they at last reached the northern suburbs; so that the entire town, with the exception, as before noted, of the portion within the walls, fell a prey to their ravages. We shall now try to depict what was here seen and befell the entire land from "Dan to Beer-sheba"* (see map, p. 542).

VINES AND FIG TREES FIRST ATTACKED

Fortunately by the time these young broods had hatched the grain crops were too far advanced to be much hurt. The reaper had already thrust in his sickle. But alas for the fruits and summer crops!

The native vineyards and orchards are always planted here in perfect confusion. Between the vines one finds figs, olives, pomegranates, quinces, and other trees. These were the places at which the locusts naturally halted, for the rapidity of their marches and the frequency of their stops seemed to be regulated by the amount of forage encountered.

Once entering a "vineyard," the sprawling vines would in the shortest time be nothing but bare bark, the long dark stems lying flat on the ground, much resembling snakes (see page 520). Fig leaves perhaps of all things best suited their taste, and when once a tree fell a prey to them the ground about would be literally layers deep, and the trunk so covered with crawlers as to make it a bright yellow color. On every leaf dozens would be perched (see page 523). They first ate away the tender parts, leaving a perfect skeleton of the large broad leaves. But soon these, too, were devoured, and usually after one day's work the tree stood naked of any leaves, with nothing but the hard unripe fruit protruding stiffly from the branches (see page 525).

When the daintier morsels were gone the bark was eaten off the young topmost branches, which, after exposure to the sun, bleached snow-white. Then, seemingly out of malice, they would gnaw off small limbs, perhaps to get at the pith within. The effect thus caused was a weird one, resembling white candles on a dried-up Christmas tree (see illustration on page 526).

"He hath laid my vine waste, and barked my fig tree: he hath made it clean bare, and cast it away;* the branches thereof are made white" (Joel 1:7).

In the same manner all fruit and many shade trees were deprived of all that made them attractive and useful. The quinces (probably the "apple" of the Bible) were stripped of leaves, and, like the figs, the fruit was left on to wither, harden, and fall off, while the pitted fruits, like the apricots, had the meat of the fruit consumed and the seed left still adhering mockingly to the tree; so that, in but a few days, Jerusalem, although never too verdant in summer, presented a sad and desolate aspect. But worse was yet to come.

FRUIT AND VEGETABLE MARKETS EMPTY

The vegetable and fruit seasons were just setting in as the young brood was hatching. Even to one looking over the local desolation the vastness of the destruction could not be realized. One day David's Street markets were full of fresh vegetables at the usual low prices. The commoner apricots from Ramleh† made their first appearance that day and were not seen again. The better ones from near Bethlehem likewise only on that day made their appearance, and it was not

*An expression taking in all of the land once belonging to the Hebrews (1 Kings 4:25).

*"And cast it away," no doubt referring to the clipping off the twigs.

†The second station on the railroad up from Jaffa, supposed to be the home of Joseph of Arimathæa, who claimed Jesus' body and laid it in his new tomb.

Photo by American Colony Photographers, Jerusalem

AMERICANS FIGHTING LOCUSTS

"In the path of the locusts was sunk a bottomless box, the inside lined with shining tin, up which the locusts could not crawl, while on each side a wing was provided, similarly prepared with a smooth metal face, with the object of directing them into the box. The fighters made two long lines, one on each side of the trap. . . . A large flag, the darker the better . . . proved to be the most formidable tool one could employ to make them move in the desired direction" (see text, page 535). Note the thickened masses driven together and just entering the trap. The locusts at this stage of their development cannot fly.

Photo by American Colony Photographers, Jerusalem

A LOCUST TRAP

"As long as they came in these endless chains, with but a little guiding, their ranks could be narrowed and practically driven from morning to night into the sunken box" (see preceding picture and text on page 535).

Photo by American Colony Photographers, Jerusalem

A LOCUST MOULTING AND HIDING PLACE (SEE PAGE 543)

The Prophet Nahum, allegorically speaking of Judah's enemies, likens them to the moulting locusts thus: "Make thyself numerous as the swarming locust. . . . The grass locust hath stripped itself and flown away! . . . Which settle in the hedges on a cold day. The sun hath broken forth and they are in flight" (Nahum 3: 17. The Emphasised Bible, Rotherham). We have before noted how the locusts hide from the cold in loose stone walls. The Hebrew word here rendered, "hedge," is *"gedarah,"* identically the same as the present Arabic name for these rubble walls, as shown in the picture.

difficult to perceive that they had been prematurely and hurriedly plucked to save them.

But these are but drops in the bucket. Miles and miles of water- and musk-melon fields fell a prey to the locusts on the plains. Likewise were destroyed the cucumber, vegetable marrow and tomato fields, and the truck gardens in plain and hill, to say nothing of the absolute annihilation of the grape and fig crops. Thousands of acres of dura, or native corn, still but a few inches tall, were eaten to the ground.

In fact, nothing escaped their ravages except the orange gardens at Jaffa, due to the heavy sea breezes and strenuous human efforts, while those of the suburbs were entirely eaten. The only vegetables now entering the Jerusalem markets came from Jericho. Here the eggs laid in the alkali fields seemed not to hatch, while those near the Jordan were thoroughly dug out; so that not a single wingless locust was seen there, and the crops remained undisturbed, till suddenly enveloped by the new fliers, as we shall see later (see page 544). The only vegetables and fruits now available came from the Jaffa gardens, but instead of being, as usual, the food for the poor, they were so rare that none but the richest could pay the price at which they sold.

INVADING THE HOMES

Disastrous as they were in the country, equally obnoxious they became about the homes, crawling up thick upon the walls and, squeezing in through cracks of closed doors or windows, entering the very dwelling rooms (see page 528). When unable to find an entrance they often scaled the walls to the roofs, and then got into the houses by throwing themselves into the open courts, such as most Oriental houses are built around. Women frantically swept the walls and roofs of their homes, but to no avail.

In Nazareth it required several hundred men to sweep the locusts together and to destroy them, and many donkeys to carry away to near-by fields the miniature carcasses. Stores were closed and some houses abandoned, for there it seemed as if the locusts were even more active than in other towns.

During the Egyptian plagues we find Moses announcing the locust scourge in terms of which our present experience is such an exact duplicate, as follows: "Behold tomorrow will I bring the locusts into thy coasts: and they shall cover the face of the earth, ... and they shall eat the residue of that which is escaped . . . . every green tree which groweth. . . . . And they shall fill thy houses, and the houses of thy servants, and the houses of all the Egyptians" (Ex. 10:4-6).

About our houses they became so thick that one could not help crushing them with every step. They even fell into one's shirt collar from the walls above and crawled up onto one's person. Women were especially troubled with them, and on one occasion a lady, after being away from home for half a day, returned with 110 of them concealed within the skirts.

Whenever touched, or especially when finding themselves caught within one's clothes, they exuded from their mouth a dark fluid, an irritant to the skin and soiling the garments in a most disgusting manner. Imagine the feeling (we speak from experience) with a dozen or two such creatures over an inch long, with sawlike legs and rough bodies, making a race-course of your back!

One warm, breathless night they were found crawling thick into our windows, which were left open after sundown, for usually during the cool nights they never moved. "They shall run to and fro in the city; they shall run upon the wall; they shall climb up upon the houses; they shall enter in at the windows like a thief" (Joel 2:9).

A FELLAH PESSIMIST

One evening of the first days of June, while fighting the locusts on Scopus, the mountain adjoining Olivet to the north, and the very ground on which Titus' Roman army pitched camp in 70 A. D., when Jerusalem was entirely destroyed (Mark 13:2), an aged fellah walked up, and notwithstanding the wholesale capture befalling the locusts, broke out with: "All this is no use; go home and rest; you can do nothing. They are Allah's army, and once they fly they will destroy everything. So it was 'sent el jarad'

Photo by American Colony Photographers, Jerusalem

AN OLIVE ORCHARD JUST AFTER THE LOCUST INVASION

The natives all spoke of how the orchards looked as if they had been attacked by fire, calling to mind Joel's words, "The flame hath burned all the trees of the field" (Joel 1:19) (see text, page 543)

(year of the locusts) when I was young. In four minutes they left all the olive trees as wood."

He walked away seemingly amused at our optimism, while we smiled, not knowing from experience, as he did, the truth of his apparent exaggerations.

ALLAH'S ARMIES

It is interesting to note that the natives all speak of them as "Jaish Allah" (God's army), they even finding the word "askar" (soldier) written in the Arabic characters upon the wings of the invading locusts. In the same way they were looked upon by the Hebrews of old. Thus: "The Lord shall utter his voice before his army: for his camp is very great" (Joel 2:11).

From the "Hadith," or books containing the collected oral sayings of Mohammed, with explanations, we translate the following: "Do not kill the locusts because they are the host of God the Most Mighty." It was so said (thus it is explained) provided they did not attempt to spoil the grain fields (that is, of the Mohammedans). For (so the story runs) a locust fell between the two hands of the Apostle (Mohammed), and it was written on its two wings in Hebrew: "We are the host of God the Most Mighty, and we have ninety-nine eggs, and had the hundredth remained to us we should have eaten the world with all that is in it." Therefore the "Apostle" said: "Our God, destroy the locust; kill its great ones and cause to die its little ones, and corrupt its eggs, and close their mouths against the plantings of the Mohammedans and their places of getting a living."

FIGHTING THE LOCUSTS

A few words of our personal experience fighting locusts may not be amiss.

At first the locusts, already having marched a considerable distance from the place of hatching, were found in endless columns "as a strong people set in battle array" (Joel 2:5). It was now easy to entrap them. In their path was sunk a bottomless box, the inside lined with shining tin, up which the locusts could not crawl, while on each side a wing was provided, similarly prepared with a smooth metal face, with the object of directing them into the box.

The fighters now made two long lines, one on each side of the trap. To noise and racket the locusts seemed only to turn a deaf ear; but a large flag—the darker the better—with which to cast a deep shadow upon the ground, proved to be the most formidable tool one could employ to make them move in the desired direction; in fact, countless numbers could thus be guided and held in check if one but anticipated the general direction they wished to go (see page 530).

As long as they came in these endless chains, with but a little guiding their ranks could be narrowed and practically driven from morning to night into the sunken box (see page 531). Now and then the trap would have to be emptied; or if the place the trap was set was to be abandoned in favor of a better position, it was an easy matter when this bottomless box was almost full to raise it out of the ground, leaving the locusts behind in the hole, and then hurriedly bury the contents. It was found by actual test that when thus buried in great masses they quickly died, and in 24 hours would develop into a putrid mass.

As the evening advanced they became sluggish and hard to move, and would crawl under individual stones, such as the fields are full of, or into small piles of rock and the common rubble walls; but by the morning again instinct would have rejoined them into bands moving together on their plans of destruction.

However, toward the end of their pupa stage their columns became shorter and less constant. They seemed to form into smaller pillaging groups, with only the acquisition of food in view. Now it became more troublesome to trap them, as they had grown large and wary. Often, after anticipating their course and while sinking the trap into the hard and rocky soil, they would become alarmed and, turning tail, escape in all directions.

TRAPPING THE LOCUSTS

One evening while trapping them on the upper side of the hill we learned just in time that an immense number were just about to enter the property from the

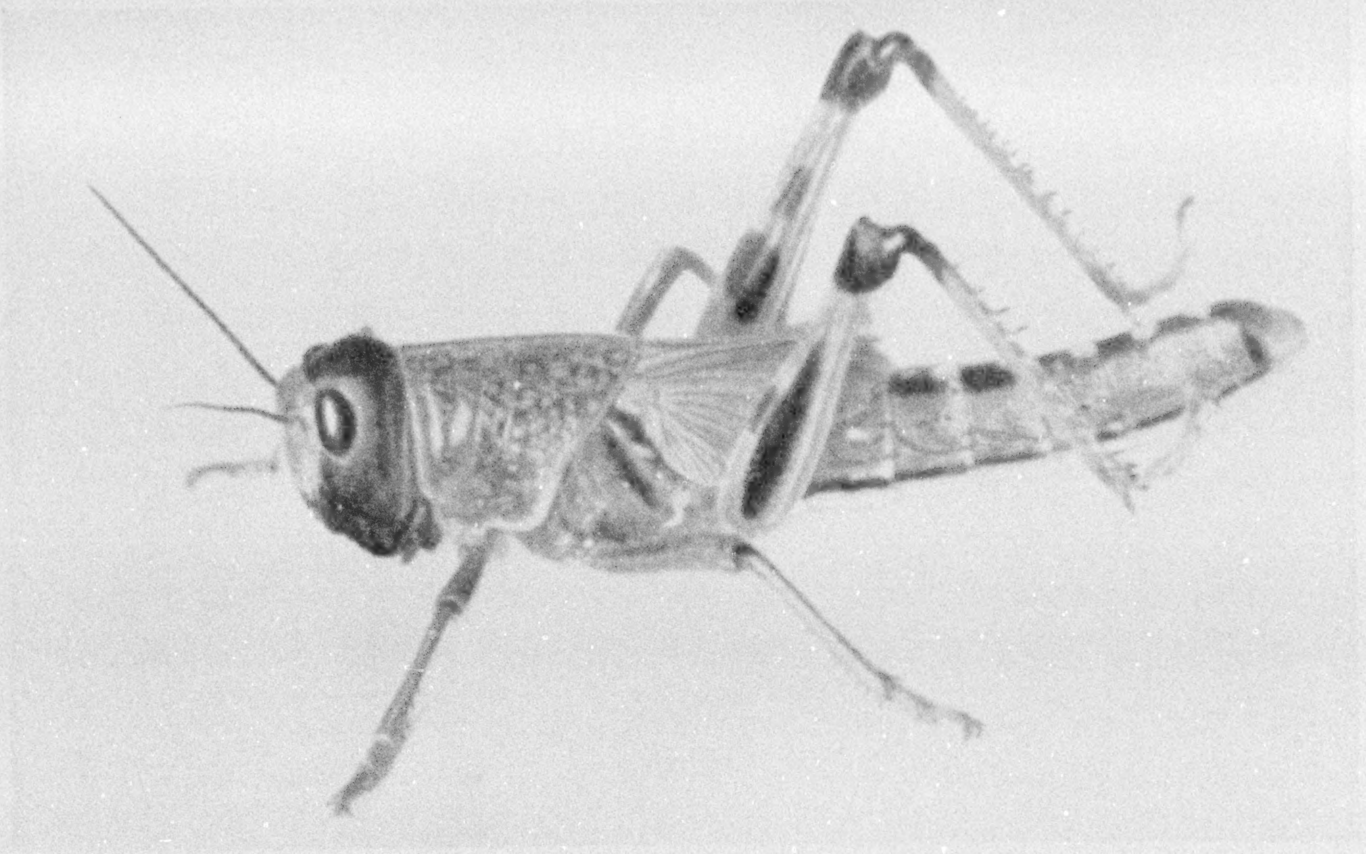


Photo by American Colony Photographers, Jerusalem

THE LOCUST (PUPA) JUST BEFORE ITS FINAL MOULT AND TRANSFORMATION INTO THE FULL-GROWN FLYING INSECT

The large wings of its future state are fully developed and neatly folded up in the four membranous cases, resembling tiny wings (see text, pages 522 and 543)

opposite side. At once all efforts were turned in this direction, and the trap was sunk into the lower edge of the field toward which they were making; but no sooner had it been set in place than the locusts again changed their course. Notwithstanding the laborious task involved, the trap had to be moved, during which process it was nip and tuck to keep the locusts from escaping. Once, however, they made in the right direction, they jumped, hundreds at a time, into this death trap.

The evening hours were now upon us; the locusts, weary from being driven and benumbed from the cool breezes, seemed to near the trap exhausted, while those behind kept piling up till the earth for a small space was covered layers deep. To facilitate matters, with spade and rake they were scraped into the trap, now constantly being emptied.

Thus in about an hour's time four large sacks full were caught and destroyed, each containing no less than 100,000 of these insects. Many escaped and made for a near-by thorny patch, on which was now piled more dry sticks and thistles, which when set afire burned alive many thousands more. The above is but an average example showing how and in what quantities they were caught.

To overcome the difficulty of the labor and time required in shifting the sunken trap, Yankee ingenuity again came to the rescue. An old box, tin-lined, was set on top of the ground, with an inclined plane leading up to it. The locusts, which can make ascents so much easier than descents, were driven into it just as easily as into the sunken trap. It was so quickly and easily placed that it proved to be a great success, the only drawback, as with the older type, being the labor of emptying it and the numbers that unavoidably escaped. The next development was a tin hopper set on legs high enough to admit of fastening a sack below. To this the inclined plane was similarly attached. Thus the locusts jumped directly into the bag, which, when full, was readily detached and replaced with another, while the full sacks, not a locust of which could escape, were so handy to carry away for destruction.

After over two weeks' steady and re-

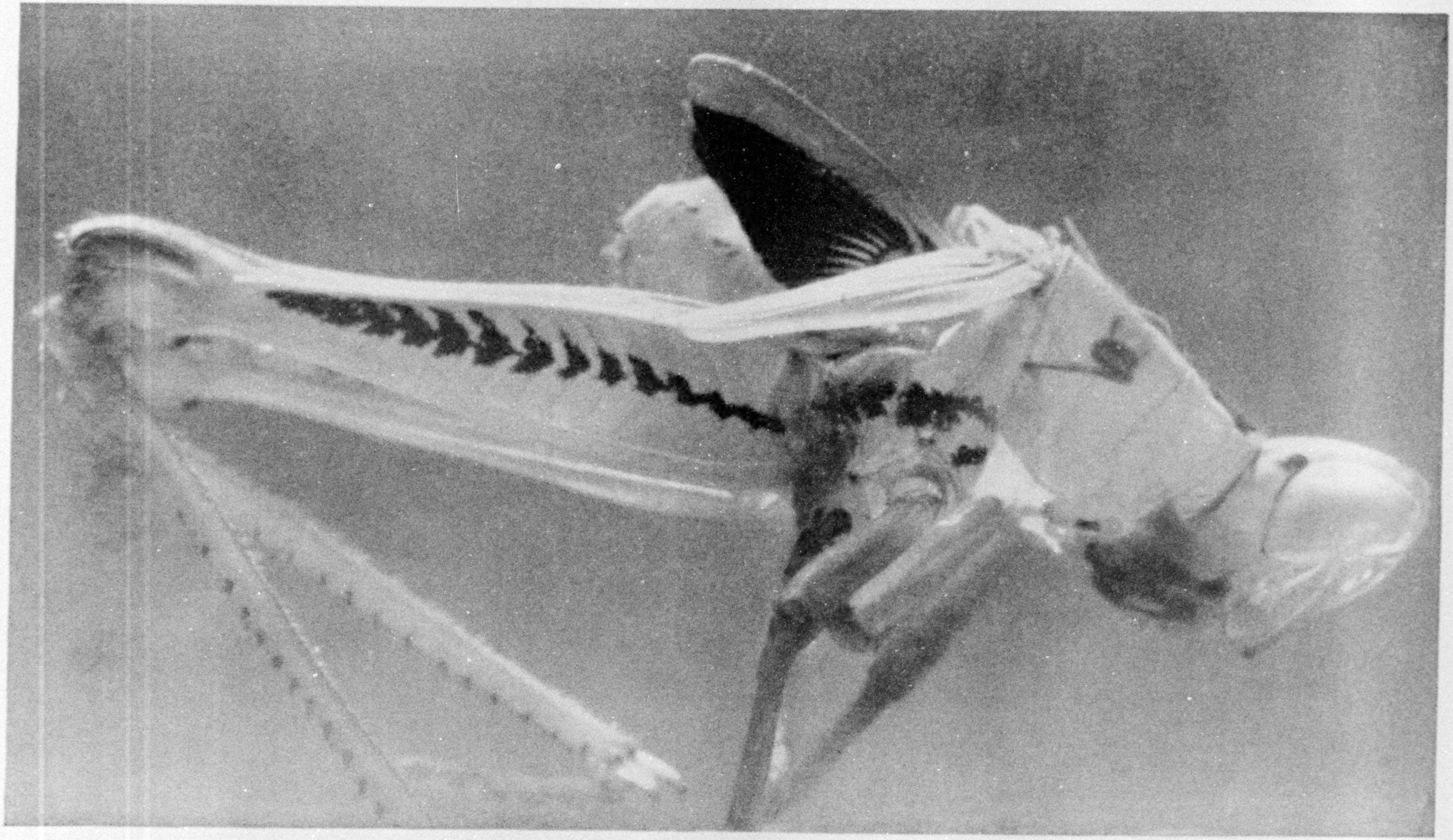


Photo by David Fairchild

THE SKELETON WHICH THE LOCUST SHOWN ON THE PRECEDING PAGE LEAVES BEHIND IT AFTER ITS FINAL MOULT

(SEE PAGES 522 AND 543)

coming stages of disaster, to say nothing of the value of a good example and the engrossing interest in observing their habits and development, we felt that the results more than outweighed the costs and efforts.

Photo by American Colony Photographers, Jerusalem

DRYING THE WINGS

The locust now has its wings in their normal shape and is ready to try to fly. As the new flying locust casts its nymph skin the colors of its body are the most delicate hues, but after a couple of days of flying they deepen into a pronounced red effect.

ESSA'S PARABLES

During the latter stages of the fight Essa had stayed at home protecting a garden from the locusts that by this time were encroaching upon the newer residential sections of Jerusalem. One evening Essa was found perched upon a rubble wall, two flags in hand, mechanically waving off the stubborn intruders. He looked as if he had an attack of something akin to St. Vitus' dance, for having been on the job for about two weeks his motions seemed automatic and almost without effort. Up to that time the locusts had tried to get into our garden only by the back wall, and at the time the writer was ignorant of their fresh efforts from other directions.

"Well, Essa, the Wrestler (for such is his nick-name), are you a gaining or losing wrestler?" Essa dropped his flags a moment as if to rest, stroked his shaggy beard and adjusted his clumsy headgear, and then added with a twinkle of his small, dark eyes:

"Master, a certain son of evil on a lonely road met a peasant taking to market two large goatskins of oil, and, coveting the superior donkey carrying them, bethought himself of a method by which to get possession of it. Pretending to be anxious to buy the oil, the owner was persuaded to unload the two skins upon

lentless work, after faces were crimson and peeling and hands blackened from wind and sun, the fight to save the fields was given up and efforts concentrated upon protecting our homes and garden plots. Was it a losing fight? The aged fellah who predicted that it was useless to combat "Allah's army" surely would have said it was. From the standpoint of dollars and cents' worth saved to ourselves, it certainly was. But when we calculated the tons' weight and countless numbers of the pests eliminated from the

Photo by American Colony Photographers, Jerusalem

A PALM FALLING PREY TO THE FULL-GROWN LOCUSTS

"Even on the scarce and prized palms they had no pity, gnawing off the tenderer ends of the swordlike branches, and, diving deep into the heart, they tunneled after the juicy pith" (see text, page 543).

XUM

Photo by American Colony Photographers, Jerusalem

A NYMPH CAMP

the ground and to open one for the supposed customer to see and taste. Once this son of evil had sampled the first skin he got the owner to hold the mouth shut while he should examine its mate. Having done so, he now pretended to wish to retaste the contents of the first skin, for which reason the owner held the second closed with his other hand. Thus the oil vendor found himself, both hands engaged, squatting between the two skins of oil, while the son of evil rode away on the donkey."

Essa smiled and his beady eyes again twinkled. "You see," he added, "while I am holding the locusts at bay on this west side, they are entering over the south wall, and I am in the same dilemma as the fellah who had both hands occupied holding the oil skins shut, and should he drop them to rescue the donkey the oil would naturally spill."

Visiting Essa the next day, it was observed that half the bean patch had disappeared, for despite Essa and our combined efforts the tenderer plants throughout the garden were slowly vanishing. Chaffing Essa in fun for thus yielding the bean patch to the ravages of so weak a foe, he again stopped his work (few Arabs can work and talk at the same time, the hands being needed to gesticulate with) and answered with a parable, which ran thus:

"A certain hunter secured a living by making shepherds' flutes of bones taken from eagles' wings. One day, being without his gun, by chance he stumbled upon a carcass on which a number of eagles were perched, stupefied from overeating. Crawling stealthily up, he seized the legs of the two largest birds. They struggled to escape; then, flapping their wings, started raising the hunter gently from the ground. Still so riveted were his thoughts upon the eight flutes he was going to make from their bones and the two megedies* he would get for each, that he did not realize his danger till too late. Looking down, he now saw the earth slowly receding from below him, when he heard a faint voice from a passer-by saying: 'Let go of one and hold on to one.' He did so, and one eagle, unable alone to sustain his weight, brought him to the earth safely, with one eagle bagged. So you see," Essa drew the lesson, "half a bean patch is better than none, just like the common saying, 'Half a stomach full removes the necessity of having a full one.'"

*A *megedie* is a Turkish dollar, equaling about 83 cents.

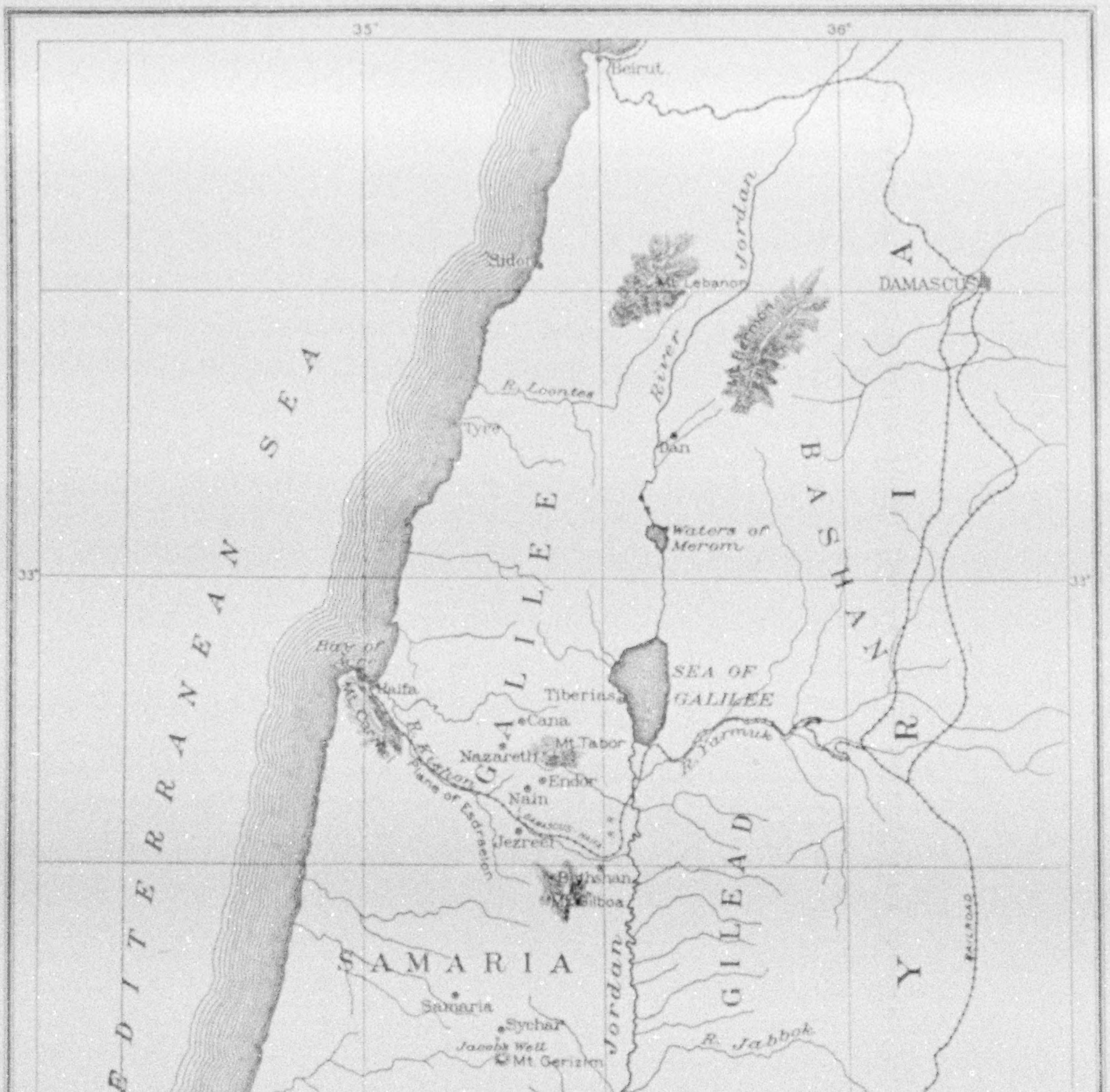
HAVOC CAUSED BY YOUNG FLYING LOCUSTS

In the early days of June a few scattered locusts of a decided red color were seen about the tree-tops. Some supposed them to be a kind of grasshopper, for they were so different in color to the fliers that first came and laid their eggs that it was difficult to detect in them the resemblance to the parents.

On the 10th of June the air all at once was filled with quantities of these new flying locusts, with the thin transparent wings, producing the effect of a large-flaked snow-storm. It was at first hard to realize that these had not, as most supposed, flown in from elsewhere, but *right under our eyes had been transformed from the small, creeping locusts—a process we shall soon describe* (*see page 543*).

During the day they kept busily hovering about from tree to tree or alighting on some green patch, while toward evening they settled for the night by myriads upon the olive trees, almost covering them and transforming the dark green foliage into a distinctive red appearance. At once they attacked the small berries, which fell to the ground like hail, along with occasional leaves, and as the fliers wrought destruction above, the creepers devoured what fell below; so that on the trees attacked often not a berry was to be found in the morning.

Up to this time the olive orchards had suffered comparatively little. The creeping locusts had not seemed to care for the tough, bitter leaves while better things were at hand, and as a rule only severely damaged individual trees where other food was scarce. But now that these ravenously hungry, freshly moulted fliers appeared, food had already become scarcer, obliging the creepers to seek the heretofore despised olive, crawling up



MAP SHOWING THE REGION OF THE LOCUST PLAGUE WHICH RAVAGED THE ENTIRE LAND FROM "DAN TO BEER-SHEBA" (SEE PAGE 529)

the trunks layers deep. Between the two they stripped every leaf, berry, and even the tender bark, leaving only, where such existed, the green tufts of the poisonous mistletoe.

Likewise every variety of tree was attacked and stripped, with the sole exception of the Persian lilac (*Melia azedarach* L.) and oleander bushes (*Nerium oleander* L.). The succulent cactus (*Opuntia Ficus-indica* L.) they seemed very fond of, but instead of commencing on the edge of the large leaves, they ate away layer after layer over the whole surface, giving the leaves the effect of having been jack-planed. Even on the scarce and prized palms they had no pity, gnawing off the tenderer ends of the sword-like branches, and, diving deep into the heart, they tunneled after the juicy pith (see page 539).

LAMPS NEVER BEFORE DIM ARE BEING EXTINGUISHED FROM LACK OF OLIVE OIL

Last spring the olive trees were overloaded with bloom and a fine crop was anticipated. Now the majority of the groves have been so severely injured as to render them fruitless for several years (see page 534). As last year was the off or bad year, olive oil, usually so plentiful, is now high-priced and almost unprocurable, and being one of the food staples of the poor, taking the place of meat and butter, the loss of this crop, combined with the grapes, no doubt will outweigh, economically and commercially, the destruction caused to all other crops combined.

From days immemorial olive oil in this land has been used as fuel for lighting sacred lamps. Because of the locusts, lamps never before dim, hanging in Christian churches in front of icons and altars, are daily being extinguished, just as the sacrifices of Judah's Temple were unwillingly suspended after the locust devastation described by Joel: "Gird yourselves, and lament, ye priests: howl, ye ministers of the altar,—for the meat offering and drink offering is withholden from the house of your God" (Joel 1:13).

One bright spot, the only silver lining to the cloud yet seen, was indirectly caused by the annihilation of the grape crop, viz., already "drinks" have doubled in price; so that it is unnecessary with Joel to say, "Awake, ye drunkards, and weep; and howl, all ye drinkers of wine," because they are already doing it (Joel 1:5).

CHANGING THE NYMPH SKINS

At first the finding of a creeping locust in the act of changing its skin was a distinct novelty, for usually the process was effected during the early hours of the morning (see also page 522).

The pupa now had its entire growth. The large wings of its future state were fully developed and neatly folded up in the four membranous cases, resembling tiny wings (see page 536).

As the pupa neared this last moult it seemed to lose all appetite and seek a refuge from its brother locusts, for reasons we shall later see. To this end dry bushes and trees entirely devastated of any green or locust food were the usual nymph camps, while rubble walls and stone piles often formed substitutes—all such situated in a sunny, warm place (see page 532).

Just as it is about to moult the small body becomes much inflated with air; the bright yellow color of its skin seems to fade away and give place to a somber brownish red, the fact being that the outer skin, just about to be shed, as it loosens from the body, becomes semi-transparent, and we can actually look through it onto the outer skin of the future flier.

As the locust labors to release itself from the old shell, we see the new eyes emerging, leaving behind their old transparent films resembling miniature automobile goggles. With much shoving and pushing, the head alone emerges, the long wings slowly unfold from the sacks containing them, and the entire body, legs and all, drops out of its old shell.

Instead of depending upon a framework of bones within its body to give it the required strength and stiffness, the locust relies upon its tough outer skin, and therefore, now that it has lost its old shell, it cannot be otherwise than limp and soft, so that it has to remain still until the hot sun and dry air have hardened and stiffened it anew.

XUM

As the locusts moult and dry they begin to try their wings—first a few feet from the ground, then into the tree-tops, where they spend about two days and nights, and with insatiable appetites build up solidly their frail bodies, till, at some unknown and unheard signal, they fly skyward, collecting like a cloud of dust in a whirlwind, and migrate. Thus every few days, after great numbers have moulted, the air all at once would be thickened by the countless numbers leaving the country, while others of the creepers moulted and took their places, finally ending in the complete clearance of the land of the pupa.

It was noticed that these new fliers never collected for migration except when a strong west wind was blowing, which therefore carried them due east.

THEY COVERED THE FACE OF THE WHOLE EARTH, SO THAT THE LAND WAS DARKENED

Twice Bedouins from En-gedi, the historic spring situated on the western shores of the Dead Sea, reported that in passing many locusts had fallen into this salt lake and were washed ashore in huge piles, which news, however, lacks confirmation. One thing seems certain from the course they took when leaving here—that they must have been making for the great desert just east of the arable range of Moab.

Similar must have been the case in Joel's experience, for we read from his minute and graphic narrative: "And the Northerner will I remove far from you, and drive him into a land parched and desolate, with his face towards the eastern sea (Dead Sea), and his rear towards the hinder sea (Mediterranean),—then shall come up his ill odour, yea his stench shall ascend" (Joel 2:20).*

That Joel depicts faithfully, if not even mildly, the bad smell of the dead locusts, no one who has got even a whiff of their putrid masses can ever doubt. In Nazareth, to which we have before alluded, where so many were crushed to death in the narrow streets, actual observers state that the air for awhile was so putrid and vile as to be almost unbearable

* The Emphasised Bible, Rotherham.

We have before noted that Jericho escaped the ravages of the creeping locusts (see page 533), but now, in passing the Jordan Valley, these fliers of recent date came in clouds sufficiently dense to darken the sun and cleared this Jericho oasis of its vegetable gardens and the leaves from the fruit trees, rendering it for a while as barren as the parched wilderness encircling it. Unlike the rest of the country, where the fliers (not to mention them in the creeping stages) remained for a couple of weeks, here the entire devastation was wrought by two visits lasting but a day or so each, after which diligent search could not produce a single locust.

Similarly, at the time of the Israelitish exodus, they formed one of the most grievous of the Egyptian plagues, and just as suddenly that plague ceased and the locusts were no more.

"And Moses stretched forth his rod over the land of Egypt, . . . and when it was morning, the east wind brought the locusts. And the locusts went up over all the land of Egypt; . . . very grievous were they. . . . For they covered the face of the whole earth, so that the land was darkened; and they did eat every herb of the land, and all the fruit of the trees, . . . and there remained not any green thing . . . through all the land of Egypt. Then Pharaoh . . . said I have sinned . . . entreat the Lord, that he may take away from me this death only. . . . And the Lord turned a mighty west wind, which took away the locusts, and cast them into the Red Sea; there remained not one locust in all the coasts of Egypt" (Ex. 10:13-19).

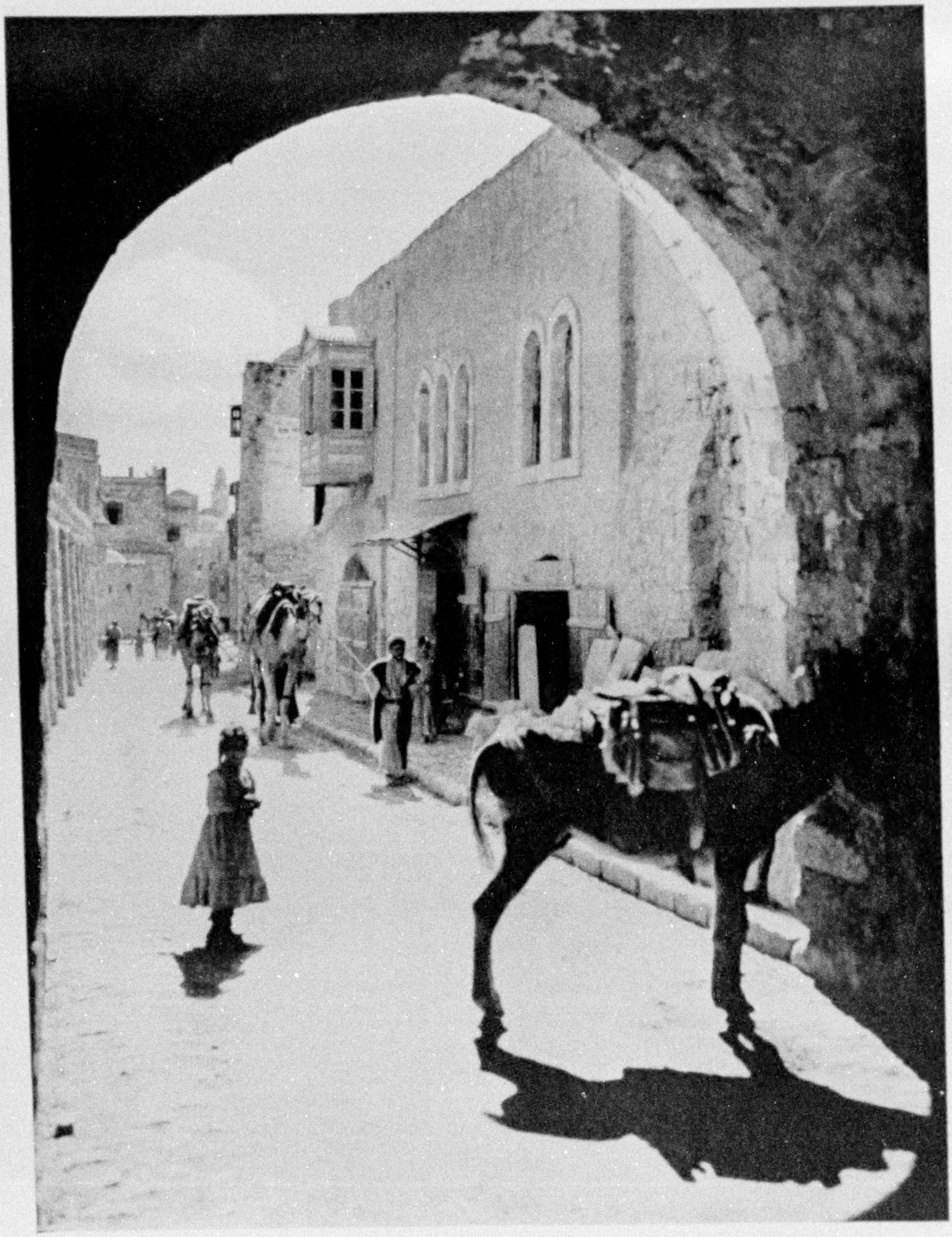
LOCUST CANNIBALISM

One strange revelation while watching the fascinating insects was to find that, contrary to expectations, locusts are not strictly vegetarians, being especially fond of the taste of flesh of their own kind.

While on the usual march, vegetable food being still abundant, it would often be seen that a larger locust would, without provocation or warning, walk up to a smaller one and with one bite nip off one of the long back legs. The victim seemed not to care, unless it happened to

THE RIVER JORDAN, WHERE THE CHILDREN OF ISRAEL ARE SUPPOSED TO HAVE CROSSED INTO THE PROMISED LAND

"One remarkable feature is the variety of soils and climatic conditions under which these eggs were laid. In the Jordan Valley, earth's lowest spot, 1,300 feet below the Mediterranean, we find them deposited on the very banks of this historic river, notably at 'the Ford,' where it is supposed the Children of Israel passed over into Canaan (Josh. 3); also farther down toward the Dead Sea, in soil heavily impregnated with alkali, where are the 'slime pits' into which probably, during their retreat, the kings of Sodom and Gomorrah fell when in full flight from Chedorlaomer and his allies" (Gen. 14) (see text, page 516).



A TYPICAL JERUSALEM STREET SCENE

"At breakfast one morning Allie brought on a most gorgeously tinted omelet, when little Spafford, fixing his astonished eyes on it and hearing that the chickens feeding on locusts were responsible for the change in color, broke out with 'Mama, if we hatched those eggs, would locusts come out with the chicks?'" (see text, page 522).

be a signal, as usually was the case, for dozens more to pounce on it, consuming the entire insect in a few moments. Sometimes a mightier one happened by and carried off the entire prey to devour by itself.

Similarly scarcely had a locust been hurt or crushed before its fellows would be found fighting over it like dogs with a bone. At times injured locusts would be found eating away at their own bruised bodies, and not uncommon was it to find a locust minus its annuli and entrails, running about seemingly unmindful of its deficiencies.

Nor was the craving for flesh restricted to locusts themselves, for they entered into beehives, and are reported to have spoiled them by eating both bees and honey. They likewise were seen eating ants.

Still more remarkable was a story told by a doctor friend who personally treated the case in question. It ran thus: A peasant woman on the plain of Sharon, during the locust pest, employed herself in trying to drive the creeping locusts out of her orchard. She took a tiny baby with her, and laying it in the shade of a tree, proceeded to her work. Returning shortly after, she found the child literally covered with the insects and its eyes already consumed out of the sockets. The writer's little boy also was bitten on the throat by one sufficiently to draw the blood.

LOCUSTS AS HUMAN FOOD

Since in Palestine and Syria locust visitations are very rare, the eating of them is practically unknown by the Arabs, while in Arabia, where the locusts make their appearances frequently, locust flesh is even found among the articles of trade.

The natives dismember the insects, pulling off legs and wings, but not the head, and while still alive roast them in a pan over a hot fire; and after being thoroughly dried in the sun, they can be stored away in sacks. The taste is said by them to be akin to that of fish.

In the Levitical law locusts are mentioned among the clean and edible animals, as follows: "These ye may eat, of all creeping things that fly, that go on all fours, such as have legs above their feet to leap therewith (*i. e.*, jointed hind legs). . . . These of them ye may eat: the swarming locust after its kind," etc. (Lev. 11:21, 22).

It will be recalled that John the Baptist is pictured as in the desert subsisting upon "locusts and wild honey" (Matt. 3: 1-4).

LOCUSTS IN ARABIC HISTORY AND FOLK-LORE

In "Hiyat el Hiwan" (Life of the Animals), by Sheik Kamal el Din el Damari, written in the year 773 of the Hegira (560 years ago), we find many a novel anecdote about the locusts, their medical properties, sayings of Mohammed and his caliphs concerning them, with primitive description of the locust itself. The following are selected quotations from this old writer, translated to preserve, as far as possible, the original author's style:

"*Jarad* (locust, from *ujrud*, meaning to scrape clean).

"When locusts come out of their eggs they are called *debbi*; when their wings appear they are called *gowga*, and when the color begins to appear in them, and the males become yellow and the females black, they are termed *jarad*. They are of different kinds—some large, some small, some red, some yellow, some white. When they want to lay eggs they choose hard places and rocks where cultivation is impossible. It strikes the place with its tail and the place opens, and in there it lays its eggs and here they are hatched and reared. The locust has six legs—two arms in the chest, two supports in the middle, and two legs on the body—and the edges of its legs are two saws. And they are of the animals that are led by a leader, and collect themselves like soldiers, and follow those which go first, whether up or down; and their spittle is pure poison for the plants; whatsoever it falls on it destroys.*

MADE OF THE SAME CLAY AS ADAM

"It was also said of Omar Ibn el Khattab† (may Allah be pleased with him!),

* Much of the above is quoted by Sheik Kamal el Din from the Koran.

† Omar, the second caliph, who in 637 conquered Syria and Palestine and received the keys of Jerusalem.

when he was caliph (that he said), 'I heard the Sent of Allah (on whom be the blessings of God and peace!) (referring to Mohammed) say that God (to whom be ascribed all honor and glory!) created one thousand nations (multitudes or hosts), six hundred of these on sea and four hundred on land, and the first to be destroyed of these nations are the locusts, and if the locusts are destroyed the (other) nations shall follow.

"The above was translated (explained) by Mehmed Ibn Essa el Abdi (to mean) that the locust was the first to be destroyed because it was created from the clay that was left over from the piece Adam was made of."

According to Tibrani, author of one of the works known as the *"Hadith,"* or oral sayings of Mohammed, the latter is credited with saying, concerning the locusts: "There is written on it 'I am Allah; there is no other God but me, the Lord of the locusts. I provide for it when I wish and send it to some as a blessing, and to others as a woe when I choose.'"

WRITTEN CHARMS TO KEEP LOCUSTS AWAY

"To keep locusts away from a field the following is used: Take a hollow reed and place in it the following inscription, and bury it in the field or vineyard, and the locusts will not harm the place by Allah's permission: 'Praise be to God, the Lord of all creatures, the Most Merciful. Blessing be on our Lord Mohammed, and upon the prophets who are associates with our Lord Mohammed, and say peace. Destroy their little ones, and kill their big ones, and corrupt their eggs, and take away their mouths from our sources of living and from our goods! Thou art the one who answers prayer. I have put my trust in God, my Lord and your Lord. There is not an animal but he looks after it. Keep me in the right path. Oh thou above all the merciful ones art the Most Merciful, grant our prayer.'

"This recipe is good and tried. One of the *ulama* (learned men), whose name at present escapes me, told me that 'if locusts infest a country, and you want to get rid of them by the help of the Almighty God, take four of those locusts and write on each of the four wings of each (locust) four texts from the Holy Book of the Most High God; then take the locusts and let the first go, saying: 'Depart from here; Allah shall suffice you; he is the all-knowing listener;' and then the second, saying: 'Put a hindrance between them and what they desire;' then the third, saying: 'Depart, may Allah cause your hearts to depart;' then the fourth, saying '(go) to where you are destined, or, if it so be, to your comrades.'"

The author of *"El Maarif"* (an Arabic Encyclopedia) gives a simpler method of fighting them, and this is found as follows: "If you see locusts advancing towards a village, hide and let none appear, and if they see no one they will pass on, and if anything is burned and it smells the burning, it will not come to that village. And they have said other things beside these."

LOCUSTS IN ARABIAN PROVERBS

"A Bedouin saying is, 'A date is better than a locust.'"

"The enemy came like wide-spread locusts."

"More barren than the locusts" (can make them).

"More noisy than the winged locusts."

"You can't catch him like Ayar's locust." (Ayar was roasting a locust and put it to his mouth before it got totally burned, and it got loose and flew away.)

"To take away freckles, anoint them with the eggs of locusts."

"If one sees locusts in their dreams, it means torment, because locusts were one of the plagues that Moses tormented the Egyptians (with)." "If you see creepers, then you will meet bad men." "If locusts fall somewhere and you eat of them, then it means plenty and abundance." "If you see it in kettles and in (cooking) pots, then you will have lots of money." "If you see it rain locusts of gold on you, then it means that God will restore to you what has been lost to you, like he did to Job, on whom be peace."

The following is a description of the locust as found in these old Arabic works and which is still commonly repeated by the natives:

"The locust has the form of ten of the

Photo by American Colony Photographers, Jerusalem

A CIRCUMCISION PROCESSION

Such events are the time for much feasting and joy. The little boy is dressed up and paraded around, riding in front of his father

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giants of the animal world, weak as he is—face of a mare, eyes of an elephant, neck of a bull, horns of a hart, chest of a lion, stomach of a scorpion, wings of an eagle, thighs of a camel, legs of an ostrich, and tail of a serpent."

A SPEAKING LOCUST

Since the present locust invasion has left the country other cures than those here related have been vouched for. According to an elderly sheik, when the locusts appeared here fifty years ago a certain Persian brought bottles of water with him from his country and suspended them in the two large mosques, and right away black birds, like pigeons, called "Samarmar," collected in endless numbers and miraculously devoured the locusts.

While the winged locusts were still here Aisha brought the news that a native of the Mount of Olives had caught a locust, and as he held it between his fingers it spoke, advising mankind not to fight the locusts; for if they did a worse calamity would befall them; and so frightened was the peasant that he took it to one of the highest officials, where it repeated what it had previously said, and at once orders were sent out to stop the locust fighting.

It is needless to say that no such orders were ever heard of. Aisha repeated the story to us as if she was ashamed to be found fully believing it, but still as if she was afraid not to, while Abu Baddir stood by and boldly placed himself as thoroughly crediting the tale.

THE FRUITFUL PALM TREE

One morning while watching the fascinating process of a locust moulting on the dry twigs of a tree (a once beautiful pomegranate in a corner of the yard), Essa was called to look on, and viewing the process for the first time, he broke out, saying, with many gesticulations: "Subhannk ya Rub" (Thy majesty, Oh Creator!), "Amant b'ism Allah" (I believe on the name of God), etc., etc.

An Occidental present mused on what might happen if these newly winged creatures should remain in the country and lay their eggs. The young larvæ would then be here just in time to destroy the coming grain crops, which this year so mercifully escaped. We shuddered at the thought, for not yet had any of them migrated, which they did subsequently, thus allaying such fears.

Essa, no longer able to contain his feelings, broke out with "Don't be foolish! Have you not been told the story of Moses and the black dog? Well, the prophet Moses (on whom be peace) once asked Allah which of all beasts he most despised, and 'the black dog' was the reply. Moses, thereupon securing a black dog, removed it into the wilderness where no one passed by and left it chained to a rock. Returning a considerable period later, Moses was surprised to find the dog well and fat, with a pure fountain of water filled with fish, on which it had been subsisting, before it.

"When Moses wondered at the sight, Allah answered: 'Oh Moses, with all life which I have created I have also created the necessary livelihood, and while I despise the black dog, yet will I not allow it to hunger.'" Thus Essa drew an optimistic moral that even should the locusts return, the "Almighty" would provide.

A story is told of an aged man planting a young date palm and of the king passing by and wonderingly questioning the peasant as to his reasons for doing so, as he never could live to see it fruit. The planter replied: "Our fathers planted for their children and we plant for our children," which answer so pleased the king that he ordered 100 gold "dinars" to be given him as a reward. Immediately the old man said: "See, oh king! the date palm has already borne fruit." The king, doubly pleased at this second reply, ordered another gift, to which again the old man replied: "See, oh king! this newly planted date slip has already borne two crops."

In like manner Essa's optimism has already borne fruit. A ship loaded with flour, sugar and rice, and a few other edibles has since arrived, sent by kind hearts and hands in America to the needy here, irrespective of creed, color, or religion. Thus the locust evil has been in part mitigated, and undoubtedly the palm tree will still continue to bear fruit.

Photo by A. W. Cutler

THE ORIGINAL DARBY AND JOAN, GALWAY, IRELAND

They are starting off to market. The old lady has not annexed her husband's pipe. It is her own. It is a far cry from the clay pipe to the cigarette used by many women of European countries as well as in our own, yet it proves the truth of Kipling's line, "The Colonel's lady and Judy O'Grady are sisters under the skin."

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Photo by A. W. Cutler

ALONG A COUNTRY ROAD IN COUNTY GALWAY, IRELAND

The keen sense of humor of the Irishman of the old school is proverbial. An English tourist, seeking local color for a story of the country and people, met an old man like the figure above, on the highroad one day. "Good-day, Pat," said the Englishman, "what race of kings do you spring from?" To which Pat replied without a moment's hesitation, "We don't spring from, Your Honor; we spring at 'em."

Photo by A. W. Cutler

TYPICAL DWELLING ON ACHILL ISLAND, ON THE EAST COAST OF IRELAND

Note the curious custom of netting the thatched roof, the ends of the net being weighted with large stones. The little colleen on horseback has been busy since daylight, bringing in many loads of peat for the campaign against the relentless enemy—winter.

Photo by A. W. Cutler

THE RETURN FROM MARKET: STILL A FEW PENNIES LEFT

A very distinct type of market woman who may occasionally be seen in many parts of England, especially around Worcester. The necessity for saving every penny in these dark days of war has come home most forcibly to every Briton, man and woman, rich and poor alike.

Photo by A. W. Cutler

FEEDING THE DUCKS. A DOMESTIC SCENE IN RURAL GALWAY, IRELAND

There has been, and is, much poverty in the bleak, unsmiling, rock-bound coast of Ireland, where getting a living out of the ground is like trying to pass a camel through the eye of a needle, yet some of the world's greatest writers, statesmen, poets and painters, not to say fighters, have come from the poor yet undaunted people of these districts.

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Photo by A. W. Cutler

A COTTAGE SCENE AT THE QUAINT VILLAGE OF LITTLE COMBERTON, WORCESTERSHIRE, ENGLAND

It does not require a great stretch of imagination to fancy such a scene as having stepped from a page of Dickens. Surely happiness and old age go hand in hand here.

Photo by A. W. Cutler

A RUSTIC WAYSIDE COTTAGE AT DEVONSHIRE, STANDING OFF THE HIGH-ROAD TO EXETER

The woman standing at the entrance to her humble home has a son at the front, and one cannot help think that the recruiting sign nailed on the gnarled old tree, which induced him to enlist, is a badge of their loyalty to king and country.

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Photo by A. W. Cutler

A GLIMPSE OF COUNTRY LIFE IN THE ABBERLEY HILLS, WORCESTERSHIRE, ENGLAND

Children are the same the world over; and the English kiddies enjoy the ride on the pasture gate just as much as our own. The outdoor life and healthful food of children in rural Britain give them an enviable start in physical development.

Photo by A. W. Cutler

IN THE HEART OF DEVONSHIRE

This scene gives some idea of the picturesque lanes which are such a charming feature of this beautiful country, so familiar to all in song and story.

Photo by A. W. Cutler

THE LITTLE GRAY HOME IN THE WEST

A rustic scene at Lustleigh, Devonshire. The romantic and stirring history of lovely Devon seems to meet one at every turn and is heightened by the quaint old houses and the splendid stands of century-old trees.

Photo by A. W. Cutler

SCENE IN A WORCESTERSHIRE FARMYARD, ENGLAND

This goose is mothering a bevy of young ducks, and, as may be observed, she is taking care of them with a considerable show of spirit.

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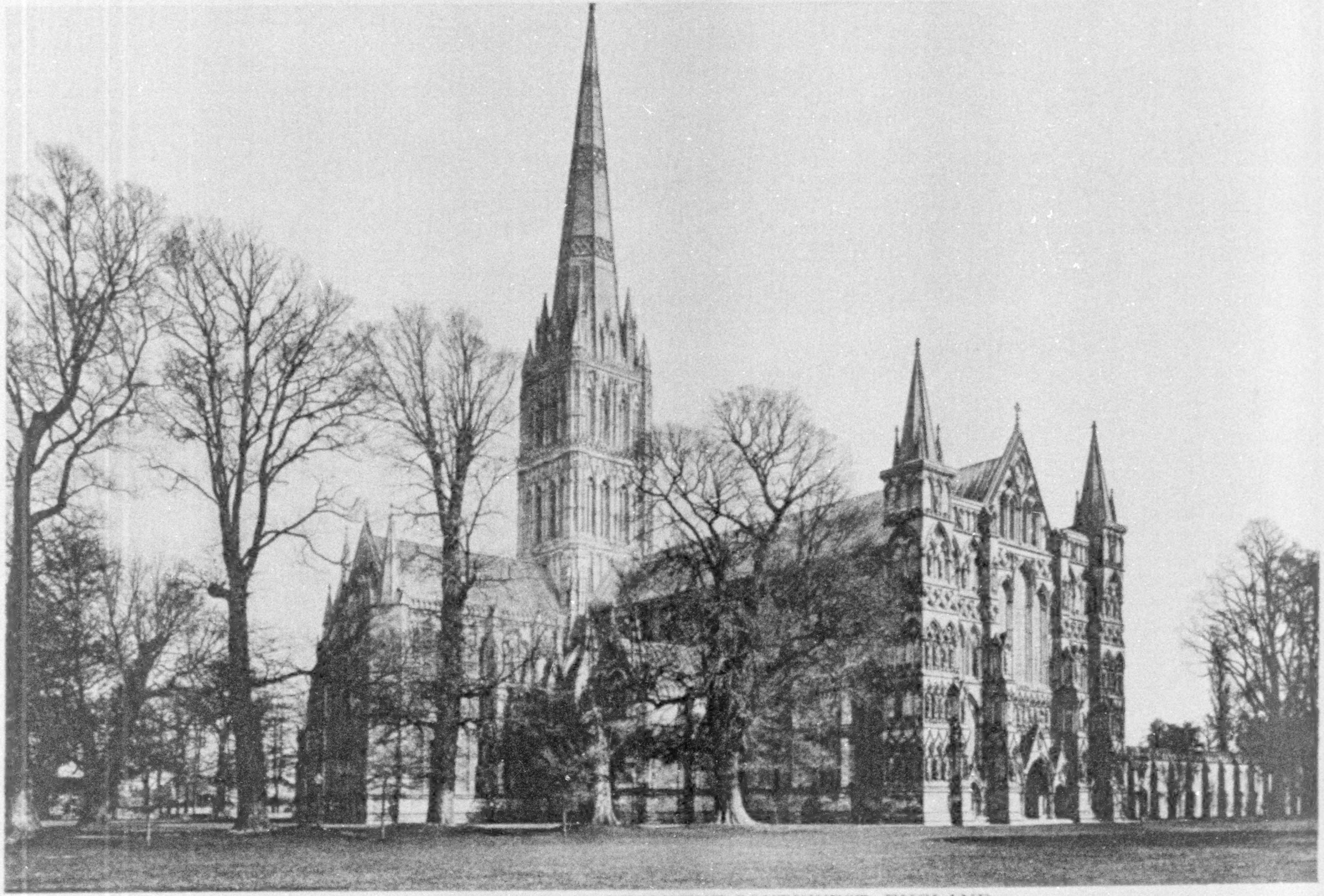
ELY CATHEDRAL, FROM THE SOUTHWEST, ENGLAND

The Cathedral of Ely is one of the largest and most imposing of the many cathedrals for which England is famous. With a length of 520 feet and a breadth of 77 feet, it yet does not sacrifice grace for size. It was begun more than 800 years ago by the first Norman abbot. Its great castellated west tower is unlike that of any other cathedral tower in England, seeming to suggest more military than ecclesiastical architecture.



SALISBURY CATHEDRAL FROM THE SOUTHWEST ENGLAND

Great Britain affords no better example of pure early English architecture than Salisbury Cathedral. Having enjoyed the rare advantage of being begun and finished within forty years (except for the final story of the tower and the spire), it is remarkable for the uniformity and harmony of its construction. There is scarcely a trace of foreign influence in the building. Great architects have declared it to be "one of the best proportioned and most poetic designs of the Middle Ages."

Photo by A. W. Cutler

AT THE CLOSE OF DAY

A simple scene at the village of Defford, Worcestershire, England. Note the timbered farmhouse of generations agone. Small wonder that England has produced so many wonderful painters when nature provides artistic inspiration along every rural pathway.

THE INTERIOR OF WINCHESTER CATHEDRAL, ENGLAND

This cathedral, except for St. Peter's in Rome, is the longest church in Europe. It measures 560 feet in length and 208 feet across the transepts and incorporates every style of English architecture from the Norman to the Perpendicular. It is popularly supposed to have been dedicated to St. Swithin, whose traditional connection with the weather is described in the unhistoric legend that the removal of his body to the shrine prepared for it was delayed for forty days by rain.

XUM

LICHFIELD CATHEDRAL, ENGLAND

This Cathedral, built of red sandstone, and dedicated to St. Mary and St. Chad, is more than six hundred years old. The diocese of Lichfield was once coterminous with the kingdom of Mercia, and no fewer than twelve other modern sees once were comprised, wholly or in part, within its borders. Lichfield Cathedral has been styled the "Queen of English Minsters," and though surpassed by others in age, size, grandeur of site, and elaborate decoration, it is not surpassed by them in exquisite symmetry, proportion or picturesqueness of general effect.

ALASKA'S NEW RAILWAY

IN AN orderly, carefully planned, economical manner, the Alaskan Railroad is being built on schedule time. Sixteen days after the President had selected the Susitna route for the government line to connect Seward and Fairbanks, engineers and workmen were on the ground at Ship Creek, Alaska, laying out and preparing the first construction camp (see Map of Alaska, 15¼ x 20 inches, in four colors, NATIONAL GEOGRAPHIC MAGAZINE, February, 1914).

In six months or less, 70 miles of purchased railroad, previously constructed by private enterprise, have been partially rebuilt and put into condition for light traffic, more than 30 miles of new roadbed have been cleared and graded, bridges and trestles constructed, and the line made ready for track-laying.

Next year will see the Matanuska coal fields opened for use by a railroad connecting them with tidewater at Seward, and a long arm of the northward line from Matanuska Junction flung toward the interior of Alaska.

From that point, the question of how soon the first locomotive whistle blows in Fairbanks will depend very largely upon how fast Congress makes available the money necessary for construction work.

As a result of the work to date, it may safely be said that the government's first great venture in railroad building will be completed well within the estimated cost, over a route which promises to show surprisingly quick returns in the development of mineral, agricultural and other natural resources, and to demonstrate within a very few years that this great Territory is indeed a veritable El Dorado (see page 585).

ALASKAN DIRT "FLYING"

Without sensational feature or incident, a force of nearly 1,500 men were at work during the past summer "making dirt fly" along the shores of Knik Arm of Cook Inlet. Engineers and surveying parties waded and swam the icy waters of glacial streams, hung suspended by ropes over high precipices, and fought mosquitoes in the marsh and tundra of the lowlands, locating the line, planning cuts, embankments, and tunnels, and determining sites for bridges along the rivers of the interior (see page 577).

The line to the Matanuska coal fields along the shifting and treacherous bottoms, and following the precipitous banks of the river of that name, has been completely located and staked, ready for the axemen, dynamite, and pick-and-shovel gangs. Northward from Matanuska Junction along the Susitna, through Broad Pass, past Mt. McKinley, and through the gorges and canyons of the Nenana River, the engineers have completed their work of location to the Tanana, from which point to Fairbanks one of three carefully investigated routes has been chosen.

So entirely without theatrical effect has been the beginning of this actual construction of the railroad which is to mark the opening of the settlement of Alaska that men in the interior, to whom for years the near vicinity of vast deposits of precious and baser metals, unutilized, and unutilizable without transportation, has been a Barmacidean feast, still refuse to credit the statement that the railroad is coming.

Although destined to be the means of bringing to the coast the Matanuska coal to smelt the copper, tin, gold, and other metals now either unmined or shipped perforce to the United States for smelting, no great caravan of treasure-hunters mingles with the laborers who dig on the road-bed for the steel highway.

GRIZZLY BEARS ROAM OVER SITES OF FUTURE CITIES

The great, brown grizzly of the north, the ptarmigan, and the shy mountain sheep of these wilds still inhabit the mountains and grassy plains destined within a decade to be the sites of busy industrial cities. The little army of workmen on Uncle Sam's newest big job eat Chicago beef or occasional game of their own shooting, within sight of meadow lands and hillsides where future herds of sheep and cattle will graze, and busy farmers will plow and plant and reap to

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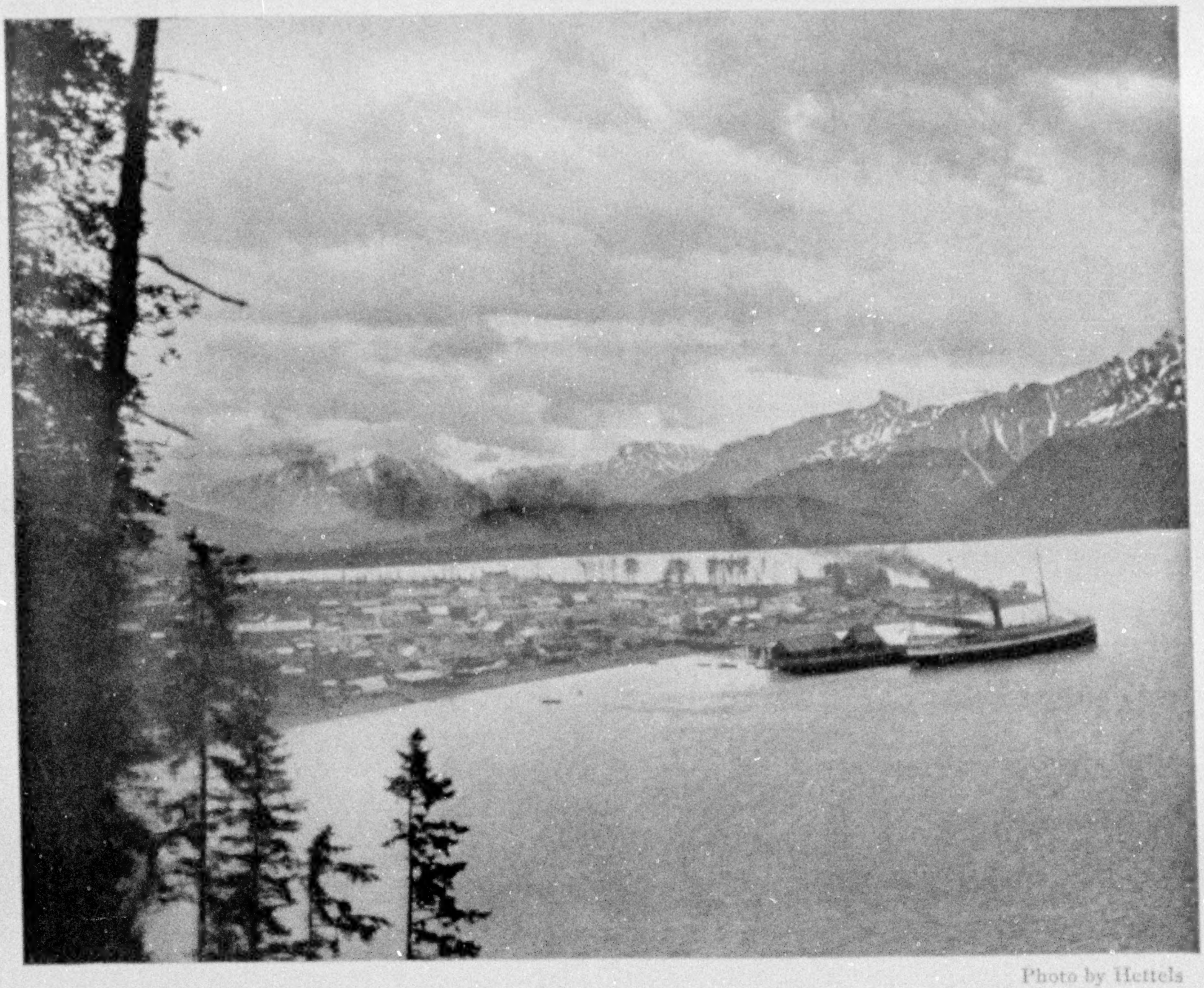


Photo by Hettels

THE TERMINAL OF THE U. S. GOVERNMENT RAILWAY AT SEWARD, ALASKA

feed the workers in the cities and mining camps (see page 586).

In May, 1914, the Alaskan Engineering Commission was created by President Wilson, to act under Secretary of the Interior Lane in making investigations of proposed railroad lines in the Territory, to enable the President to decide on the most available route from an ice-free harbor in the south to the navigable, winter-bound rivers of the interior. The act of Congress of March 12, 1914, had authorized the President to locate, build, or purchase and operate a system of railroads in Alaska, at a cost not to exceed $35,000,000. An appropriation of $1,000,000 was made immediately available.

The government was particularly fortunate in the selection of the members of the Engineering Commission. The men chosen are leaders in their profession, of wide experience, and possessed of the imagination, determination, and fertility of resource which equip them thoroughly for their difficult task of penetrating the mountains and wilds of unsettled country, locating and building therein a railroad.

NO MORRIS-CHAIR JOB

Their's was no Morris-chair job. It was not a matter of sitting in a comfortable office and directing activities of a field force, but of each member of the Commission personally leading and directing exploring parties, seeing the country with his own eyes, and amid the glaciers, streams, mountains, and valleys selecting with careful judgment a safe and practicable route for a great governmental highway, intended to open to settlement the last great wilderness of the United States.

William C. Edes, of California, chairman of the Commission, was chief engineer of the Northwestern Pacific Railway at the time of his appointment. Many eminent engineers and railroad men recommended him as the best qualified engi-

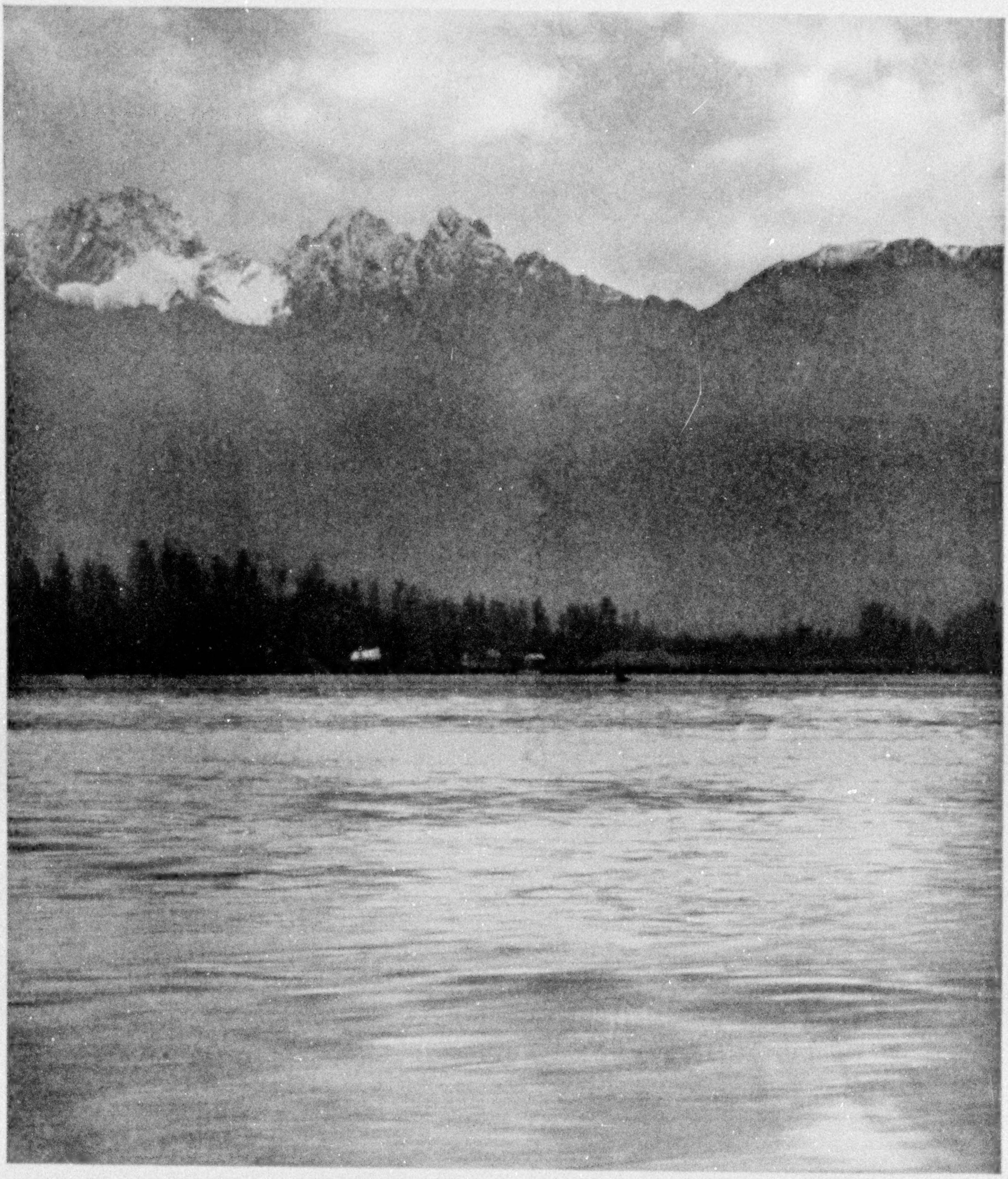


Photo from U. S. Department of the Interior

VIEW LOOKING SOUTH, SHOWING THE SITE OF THE PROPOSED ALASKAN RAILROAD CROSSING OF MATANUSKA RIVER

neer in the United States to locate and build the Alaskan road. He has located and built some of the most difficult railroads in the West. Mr. Harriman chose him to locate the new lines across the Sierra and the Siskiyou Mountains. The Alaskan work is in his charge, and associated with him are two younger men—Lieut. Frederick Mears, U. S. Army, and Thomas Riggs, Jr., of Utah.

Lieutenant Mears is one of the young veterans of the Isthmian Canal construction. As superintendent of the Panama Railroad, he relocated and reconstructed a large part of that line and operated it successfully. Governor Goethals recommended him as the best equipped of all the excellent engineers at Panama to grapple with the difficult problems of railroad location and construction in Alaska.

Photo by Laurence

VIEW OF UPPER KNIK ARM, JUST SOUTH OF MOUTH OF KNIK RIVER: ALASKA

This picture was taken September 28, 1915. "Knik Arm is a narrow reach of Cook Inlet. On its shores is the town of Anchorage, the basic camp for the building of the Alaskan railroad" (see text, page 576)

Mr. Riggs brought to the Commission an intimate knowledge of Alaska and Alaskan conditions, having lived in and explored that country for the greater part of 16 years prior to his selection for membership on this Commission. At the time of his selection he was chief of the Alaskan Boundary Survey.

THE PRELIMINARY SURVEYS

The summer and early fall of 1914 were devoted to examinations and investigations of the several routes from the sea to the interior of the country. About half a million dollars were spent in this work, which necessitated the organization of no less than fourteen field parties, each headed by an experienced engineer or topographer. These parties were made up of from fifteen to twenty men each.

Quick action and results were demanded and secured. On May 2, 1914, President Wilson directed and authorized Secretary Lane to take such action as was necessary in having these surveys made. On May 8 the Secretary of the Interior directed the members of the Engineering Commission, who in the meantime had been selected and appointed by the President, to proceed to the field.

The Commission arrived in Seattle May 22, rented offices, started the necessary machinery in motion to complete the organization, employed the additional men required, and purchased and shipped to Alaska the necessary supplies and equipment for pushing the several surveys. The ordinary method of carrying on surveys in the interior of Alaska, and the most economical, would have been to transport supplies by sled through the snow in winter, "caching" them at intervals for summer use.

It was too late in the season, however, when the Commission began its work, to use this method, and expensive pack outfits had to be organized to transport the equipment and supplies of the fourteen parties which were formed for the survey work. One hundred and twenty-eight horses and mules were purchased in the Northwestern States and taken to Alaska with the survey parties. Seventy-four others were bought in Alaska.

The first party left Seattle on May 26 for Alaska, and the entire organization was in the field by a little after the middle of June. Two general routes from the coast to the interior were investigated by the Commission: First, the route starting from Cordova, or Valdez, and extending northward by the Copper River, Tonsina River, Delta River, and Tanana Valley, in the vicinity of Fairbanks; second, the western route, starting from Portage Bay, or Seward, and following the shores of Turnagain and Knik Arm; thence northward up the Susitna Valley through Broad Pass, and down the Nenana River to its junction with the Tanana, and thence by one of the suggested routes to the vicinity of Fairbanks.

APPORTIONING THE WORK

In the division of the work to accomplish this general result, two parties made a survey and valuation of the Alaskan Northern Railroad, and explored alternative routes along the Kenai Peninsula. Another made a careful survey in the vicinity of Passage Canal, while still another surveyed the route from the Passage Canal northward for probably 65 miles. Three parties covered the remainder of the distance of the western route to Broad Pass and surveyed a branch to the Matanuska coal fields. Five other parties covered the country north of Broad Pass, one party surveyed from the Susitna to the Matanuska coal fields, one party surveyed a connection between the Matanuska coal fields and the Copper River and Northwestern Railway at Chitina, and one party made a reconnaissance from the Susitna to the Kuskowin and the Iditarod country.

These parties were each in charge of a skilled locating engineer, topographer, or reconnaissance engineer, and were composed of assistant engineers, transit men and levelers, chainmen, rodmen, axemen, cook, and cook's assistant. Each had an adequate pack-train for transporting equipment and supplies, and in the section where game was known to be abundant, hunters were attached to several of the parties to keep them supplied with fresh meat, both for the purpose of reducing the cost of subsistence and for

METHOD OF TRAPPING CUTS INTO SMALL CARS

Photos by Laurence

WHERE THE U. S. GOVERNMENT RAILWAY BEGINS TO STRETCH AWAY FROM THE SEA TO THE COAL FIELDS

economizing the bulk of supplies necessary to be transported.

A 50-foot stern-wheel power-boat, equipped with a 50-horse-power engine, was designed and built in Seattle for use in transporting supplies and making reconnaissances of the shallow water of the Susitna River and its tributaries (see pages 582 and 583), and, through the courtesy of the Commissioner of the Alaskan Boundary Survey, the Commission secured the temporary transfer of the Survey's power freight-boat *The Midnight Sun* for use on the Nenana and Tanana.

HEADQUARTERS ESTABLISHED

Two headquarters or main bases of supplies were established, from which the survey parties worked, one at Ship Creek and one at Fairbanks. All of the survey parties completed their work by the middle of October. Shortly afterward the members of the Commission returned to Seattle, and later to Washington, collated their data, completed their maps and estimates, and by February had placed in the hands of the Secretary of the Interior for presentation to the President their report on the characteristics and desirability of the several routes and branches proposed, with estimates of their cost.

This report included maps on a scale of 1 inch to 400 feet of all parts of the proposed routes where locations were made, showing detailed topography for some distance on either side of the line, and a general contour map on the scale of 1 inch to 5,000 feet, with profiles of preliminary locations.

In addition the engineers presented reports on the physical characteristics through which these routes pass, character of the soil, mineral resources and agricultural possibilities, and a mass of other detailed and related information. A competent bridge engineer employed by the Commission has also gone over the plans for structures and estimated their cost.

BUYING EXISTING LINES

Of the existing railroads in Alaska, the Commission confined its investigation to those lines which might reasonably be utilized as a part of the proposed general systems. The roads examined and reported upon in this manner were the Copper River and Northwestern Railway, a standard-gauge line 196 miles long, built from Cordova, on Orca Inlet, to Kennicott; the Alaskan Northern Railway, standard gauge, from Seward, on Resurrection Bay, to Kern Creek, on Turnagain Arm, a distance of 70.8 miles; and the Tanana Valley Railroad, a narrow-gauge line, extending from Fairbanks and Chena northward 46 miles to Chatanika.

After a study of these reports and maps, President Wilson selected the western or Susitna route as possessing superior advantages for the construction of the first line into the interior. The engineers estimated that the completion of this road, which with its branches will be something over 500 miles in length, would cost upward of $27,000,000.

The President authorized the purchase of the Alaskan Northern Railroad as a part of this line at a price of $1,150,000.

The decision of the President to adopt the Susitna route was made on April 10, 1915, and at the same time, by executive order, the duties of the Alaskan Engineering Commission were extended to include the construction of the proposed railroads.

SURVEYING THE SUSITNA ROUTE

In 1914 surveying parties had reached the field in Alaska within three months after the approval of the act of Congress authorizing the construction of the railroad. In 1915 engineers and workmen were on the ground and attacking the job of laying out the first construction camp, sixteen days after the President signed the order designating the route to be built.

This route begins at Seward, on Resurrection Bay, and is to extend to Fairbanks, on the Tanana River—a distance of 471 miles. From Seward it follows the shores of Turnagain and Knik arms to the Matanuska River, and thence runs northward along the drainage of the Susitna River, penetrates the mountains of the interior through Broad Pass to the Tanana River, which it crosses, and

Photo by Laurence

THE BASE CAMP FOR RAILROAD CONSTRUCTION: FOURTH STREET, LOOKING EAST, ANCHORAGE, ALASKA

"The fact that the sale of liquor is prohibited in Anchorage, and that town lots there are sold with a prohibition clause attached and delivery of title deferred five years, probably has had something to do with this condition. . . . A jail was built and a marshal appointed at the opening of the Anchorage townsite to settlement, but the jail has been empty most of the time and the marshal has had practically nothing to do" (see text, pages 576 and 578).

Photo by Laurence

THE TENT VILLAGE ON NORTH BANK OF MATANUSKA RIVER, CALLED "MATANUSKA LANDING"

"Next year will see the Matanuska coal fields opened for use by a railroad connecting them with tidewater at Seward, and a long arm of the northward line from Matanuska Junction flung northward toward the interior of Alaska" (see text, page 567)

XUM

thence follows a route yet to be finally determined to Fairbanks. The Alaska Northern Railroad from Seward through the Kenai Peninsula, 71 miles to the head of Turnagain Arm, is included in the route.

Of the purchase price of $1,150,000 for this existing road, $504,188.49 was paid August 25, 1915, and the remainder is to be paid July 1, 1916. The price given for this road, about $16,000 a mile, including its rights of way, water front and docks, office building and yards at Seward and some light equipment, is less than the physical valuation of the property as made by the Engineering Commission.

PASSENGER SERVICE 12½ CENTS PER MILE

The road is standard gauge, as the entire government line is to be. It is well located and fairly well constructed, but in recent years has been neglected and allowed to fall into decay. The engineers estimate that from $700,000 to $800,000 will have to be spent eventually to put it into perfect running condition. Owing to the legal delays in securing title to the property, it was too late in the season when the purchase was consummated to make many of the needed repairs and improvements. The government is running a gasoline motor-car over a part of the line on a regular schedule, giving passenger service at 12½ cents a mile and freight service at 1¼ cents per pound for the 35 miles in operation.

From Matanuska Junction near the head of Knik Arm, where the main line of the government route crosses the Matanuska River, a side line 38 miles in length is to be built to Chickaloon, in the Matanuska coal fields. The grade from these coal fields to the new government townsite of Anchorage, on Ship Creek, is 4/10 of 1 per cent. As the winter climate in this part of Alaska is no more rigid than in Washington or New York, although with a somewhat greater snowfall, it is anticipated that Matanuska coal will be shipped throughout the entire year to tidewater at the ice-free port of Seward, from which point cheap water transportation will make it easily available at the many cities along the southern shore, and will quickly lead to the establishment of smelters for the copper ores of Alaska.

ANCHORAGE'S ADVANTAGES

After careful investigation, Ship Creek, now known as Anchorage, was selected as the base camp for railroad construction. This townsite, 120 miles from Seward, is on Knik Arm of Cook Inlet at the head of navigation for ocean-going steamers. It is within 5 miles of the main line of the railroad with which it has been connected by a branch (see page 570).

Although there is some ice in these waters during the winter, its advantages as a base and as a shipping point for supplies lies in the fact that it brings water transportation to a more northern point along the railroad and enables distribution of materials from there in both directions along the line, both by rail and water. Supplies to go by water are transhipped to shallow-draft boats and barges for points further south along Turnagain Arm, while in the same manner freight and supplies can be borne by water for nearly 100 miles up the Susitna River.

Anchorage will be an available shipping point for the products of the Matanuska coal fields and for freight brought from the interior for at least seven or eight months in the year. A townsite has been created here, and where a year ago was only a wilderness is now a town of about 2,000 population. An auction sale of lots by the government resulted in the sale of 749 lots at a total price of $164,210. Streets are being improved and many permanent buildings are in course of erection (see page 574).

ECONOMICAL UNLOADING

The methods employed to safeguard the interests of the government are illustrated by those adopted for unloading supplies and materials at Anchorage. The extremes of tide here are nearly 40 feet, and on the flood and ebb there is a current of from four to six miles an hour. Because of these facts, steamers cannot go to the dock and must be unloaded with lighters and barges.

The old method was to bring the

Photo from U. S. Department of the Interior

SURVEYING ON GOLD STREAM: ALASKA

The men in the picture are wearing mosquito veils. "Engineers and surveying parties waded and swam the icy waters of glacial streams, hung suspended by ropes over high precipices, and fought mosquitoes in the tundra of the lowlands and marshes, locating the line" (see text, page 567).

barges to the shore at high tide, let them rest on the beach as the tide retreated, and then unload and wait for the next high tide to float them off for another load. This practice involved delays in unloading, and demurrage on steamers in those waters is from $150 to $200 a day.

In constructing the temporary railroad wharves cradles, or "gridirons," were built alongside the docks, with pile foundations, over which the barges are floated at high water, and upon which they rest steadily as the tide recedes, the unloading difficulties being diminished by having the barges stationary while their contents are being lifted out and placed on the dock in nets or packages by the 15-ton stiff-leg derrick. As the barges and lighters may be moved on a mean tide and taken off and onto the "gridirons"

without waiting for the full flood, this also makes a saving in time.

NO DEMURRAGE PAID

To further obviate the necessity for paying demurrage, a 1,000-ton barge was purchased in Seattle, to be delivered at Ship Creek at the risk of the seller. Four smaller scows were also purchased, and upon the arrival of all this equipment the large scow was placed in use as a floating dock, enabling a ship to discharge its cargo without delay, and the smaller scows are used as lighters with which to carry the cargo from the barge to the wharves. With this system the government has no demurrage or dockage charges to pay. A cargo of nearly a million feet of lumber was discharged in this way in three days, with shifts of workmen working day and night.

In executive orders directing the construction of the railroad, President Wilson, at the outset, urged upon the Commission that provision should be made for safeguarding the health and life of employees and workmen on the road, and for caring for the sick and injured. To this end, a hospital, located in a log building, but well equipped, was one of the first preparations made at Anchorage, and here care has been given the small number of employees disabled during the season.

There have been, however, none of the conditions to contend with here that the engineers had to fight at Panama. There is little sickness in Alaska. Malaria and other fevers are practically unknown, and the uncontaminated water supply, equable climate, and good air make epidemics practically impossible. A few cases of axe cuts and minor injuries have been about the extent of cases requiring hospital treatment.

AN EMPTY JAIL

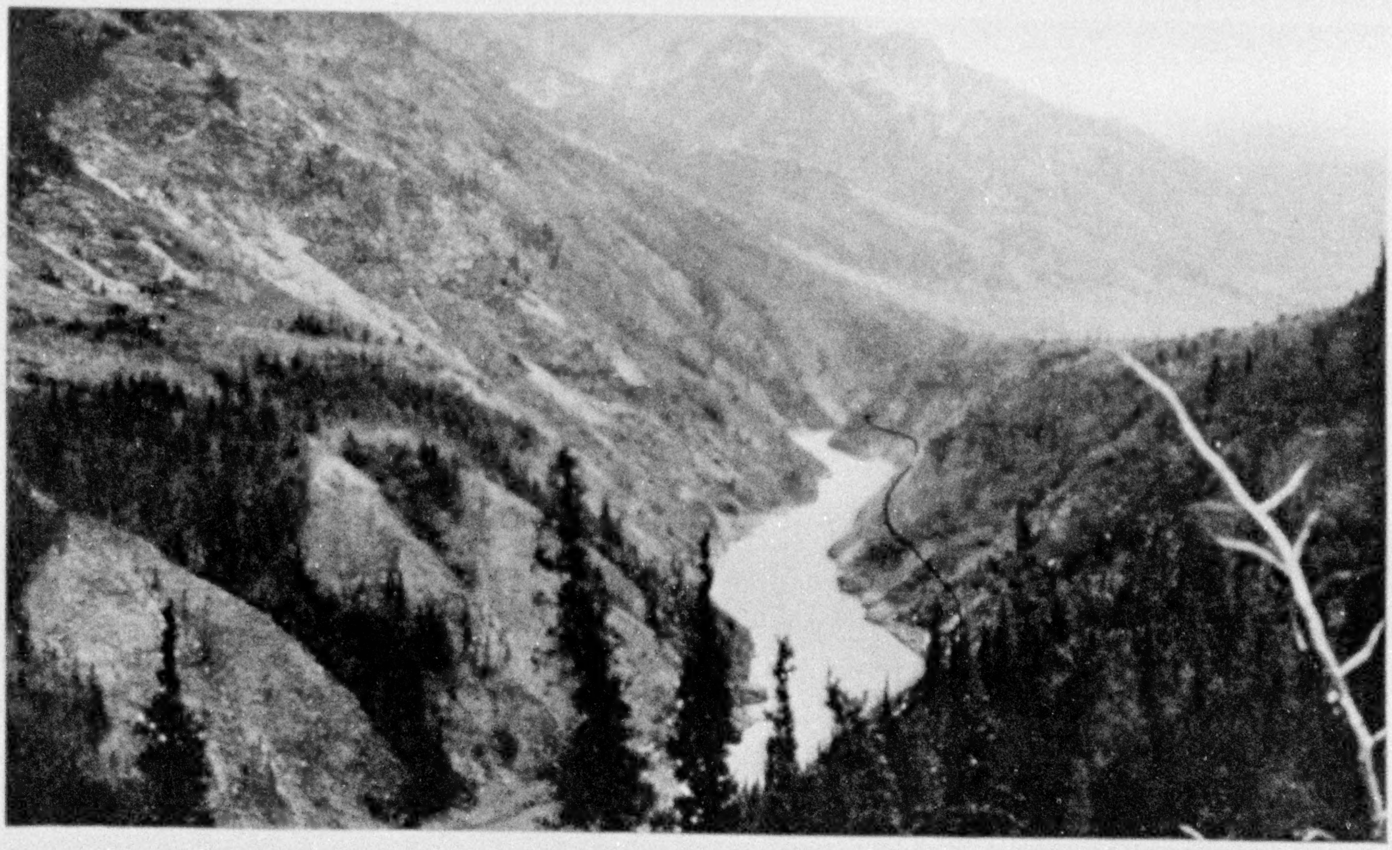
In this connection, too, it might be said that Alaska's good reputation as a country of law-abiding people has been maintained during the first season of the railroad construction and even in the opening and boom days of Anchorage. The fact that the sale of liquor is prohibited in Anchorage, and that town lots there are sold with a prohibition clause attached, and delivery of title deferred five years, probably has had something to do with this condition, while the isolation of the country and the difficulty of escaping detection and apprehension has also doubtless had much to do with curbing lawlessness. A jail was built and a marshal appointed at the opening of the Anchorage townsite to settlement, but the jail has been empty most of the time and the marshal has had practically nothing to do (see page 574).

Out of the appropriation of 1914 about $500,000 was available for use this year and was spent in making the first payment on the purchase of the Alaska Northern Railroad. With the $2,000,000 appropriated for this year it was planned at the beginning of the season to make a final location of the entire route, to rehabilitate partly the Alaska Northern, and to construct as much of the new line as possible.

PANAMA EQUIPMENT

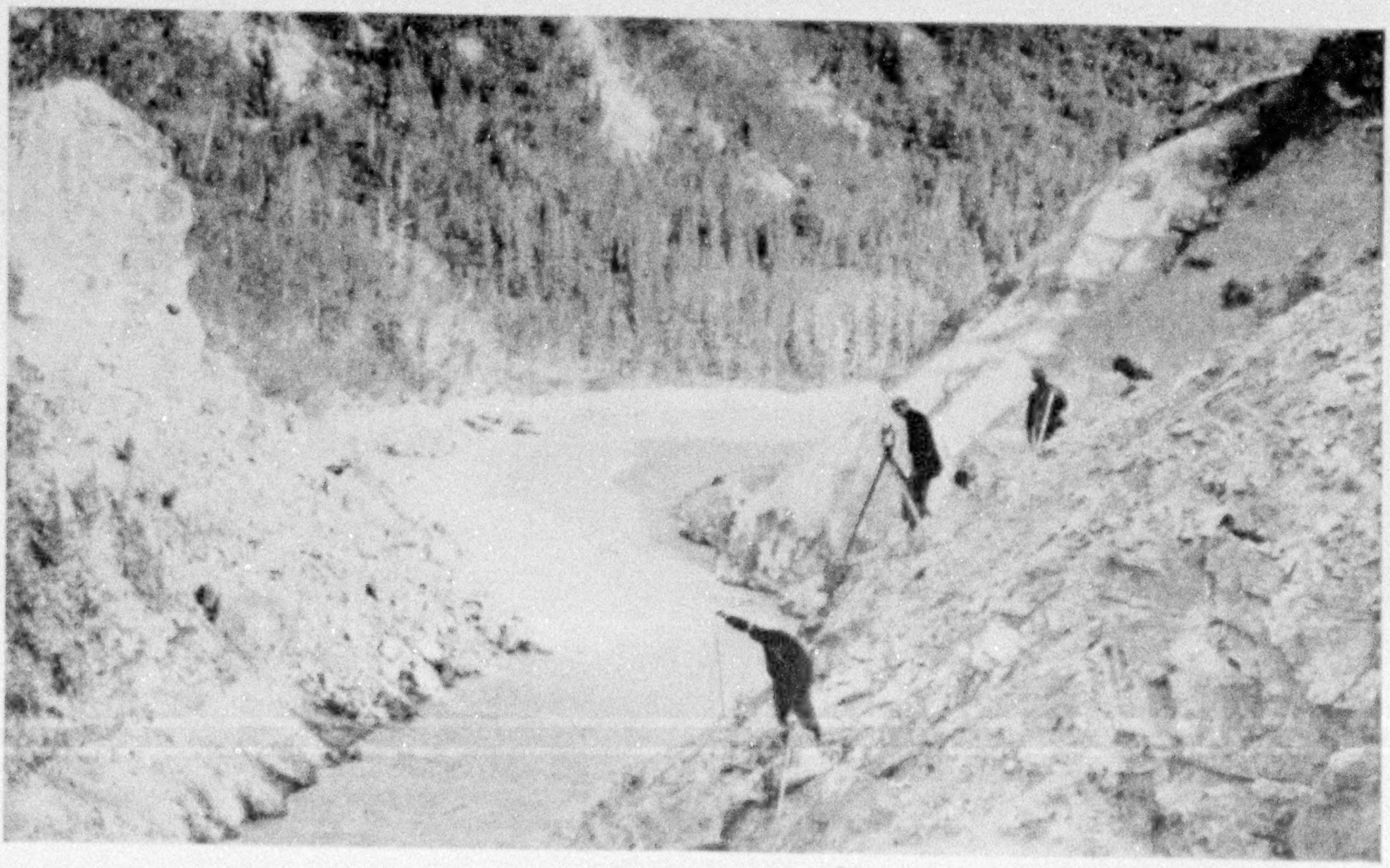
Large quantities of construction supplies and materials have been landed at Anchorage, including a lot of steam-shovels, derricks, bridge timbers, structural steel, locomotives, flat cars, wheels, boilers, drills, shop machinery, etc., from the Panama Canal. The road-bed from Anchorage to Matanuska Junction, 35 miles, has been practically completed and made ready for track-laying, including the construction of bridges and trestles. Shipments of rails are now being received, and it is anticipated that by the first of January, 1916, this division of the line will be completed and ready for use.

Steel rails have been purchased at $30 a ton, for the 70-pound size of which the road will be built. A significant incident illustrating the advantage enjoyed by the government over private interests in purchasing and in transportation is the fact that, although the freight rate on rails to Seattle, from the mill which received the contract, is $9 a ton and the government rate on the land-grant railroads for the same service is $6.15 a ton, one of the railroads voluntarily made a special rate of $5 a ton for hauling these rails.



THE UPPER PART OF NENANA CANYON, SHOWING ROUTE OF RAILROAD

"The coal of the Nenana fields, on the northern part of the railroad, is a high-grade lignite, which is expected to furnish cheap and excellent fuel for domestic and industrial purposes" (see text, page 589).



Photos from U. S. Department of the Interior

DIFFICULT SURVEYING IN NENANA CANYON

Photo by Curtis & Miller

CLARK GARDEN AT SKAGUAY, ALASKA

"In this way each man becomes a small contractor and shares equally with all others in the returns from the job, the middleman being eliminated, and the associated contractors on the job being paid for what they accomplish, not for the time they put in" (see text, page 583).

Photo by Johnson

COAL OUTCROPPINGS ABOUT SIX MILES UP LIGNITE CREEK: NENANA COAL FIELDS

By executive order, the timber on a strip 5 miles wide on each side of the railroad route, from Turnagain Arm to Chickaloon and Fairbanks, was early last summer reserved for the use of the Commission for construction purposes. Legislation was also enacted in the last Congress whereby timber may be taken free of charge from the Chugach Forest Reserve.

TIMBER FROM SEATTLE

Because of the fact that the large timber through much of this region is widely scattered, however, and the additional fact that it is largely cottonwood or other soft varieties, while much of the spruce is small and knotty, it was found impracticable to utilize the local timber supply exclusively in securing lumber for bridge and other heavy construction, and lumber has been brought in from Seattle, at a delivered price, as low as $19 per thousand feet. The local timber will be relied upon mainly to supply piling and crossties for the entire length of the line. With the beginning of work of the railroad last spring there was a threatened stampede to Alaska in search of employment, incited by the popular notion of high labor prices prevailing there, and the probable belief that the government would pay higher wages than private employers. So far as possible this stampede was checked by giving publicity to the facts, but even then the Commission was not able to give work to all of those who applied.

Most of the clearing and grading work on the railroad is being done by contract, on the "station" or "piece-work" system, which has been followed generally in railroad construction in the Western States for years. A gang or number of men associate as partners and are given the contract for clearing right of way at so much an acre, or for grading at rates per cubic yard, according to classification. When the contract is finished the work is measured up and the gang paid at the

Photo by Curtis & Miller

A FIELD OF RHUBARB AT SKAGUAY, ALASKA

Photo from U. S. Department of the Interior

FERRYING HORSES ACROSS THE TANANA RIVER

Photo by Laurence

THE COMMISSION'S STERN-WHEELER BOAT, "MATANUSKA," LANDING SCRAPERS AND WORK HORSES NEAR MATANUSKA RIVER

"A 50-foot stern-wheel power-boat, equipped with a 50-horse-power engine, was purchased in Seattle for use in transporting supplies and making a reconnaissance of the shallow water of the Susitna River and its tributaries" (see text, page 573).

agreed price, every man receiving an individual check for his share.

SMALL CONTRACTORS

In this way every man becomes a small contractor and shares equally with all others in the returns from the job, the middleman being eliminated, and the associated contractors on the job being paid for what they accomplish, not for the time they put in. Probably a thousand men have been employed on the road this summer in this manner, and their earnings have been good as a rule, depending, of course, on the individual ability of the men and of the gangs. These contractors are not boarded by the Commission, but are allowed to buy supplies and provis-

Photo by Curtis & Miller

FLOWER GARDEN AT VALDEZ, ALASKA

Many parts of Alaska are destined to become famous for their equable climate. For instance, the summers of Sitka are cooler and the winters warmer than those of Washington. The average temperature for the year is only one degree lower than that of the National Capital.

ions from the Commission commissary at reasonable prices.

No racial, sectional, or political distinctions have been made in accepting or rejecting applicants for employment. Ordinary day laborers receive about $3 a day, and are charged a dollar a day for good board at the construction camps. Eight hours constitute a day's work, and the eight-hour law has been strictly enforced. This does not, of course, apply to the "stationmen," who are contractors, and there has been some criticism of this system. It appears, however, that the complaints concerning conditions on the job do not come from the workers themselves, but from outsiders who are not so desirous of work as they are of sharing in the government appropriation.

FREE HOSPITAL CARE

A system of compensation has been adopted to provide for the care and benefit of disabled employees and the benefit of the families of any who may die of injuries received on the work. Free hospital attendance and medical attention is given by the government to all employed on the construction, whether employees or contractors; and when it is decided that injured or sick employees should be removed to Seattle or elsewhere for special treatment that they cannot receive in camp or at the Anchorage hospital, the expenses of their removal and treatment are paid by the government.

Early in the summer the Commission was authorized by Secretary of the Interior Lane to provide a recreation and amusement hall at Anchorage for the benefit of employees and their families, and this has proven a popular and much appreciated feature, which bids fair to be of even greater popularity during the long nights of the winter season.

Engineers and employees attached to

Photo by Curtis & Miller

CABBAGE GROWING AT FAIRBANKS, ALASKA

The Alaskan Railroad route "promises to show surprisingly quick returns in the development of mineral and agricultural resources and other natural resources, and to demonstrate within a very few years that this great Territory is indeed a little El Dorado" (see text, page 567).

parties in the field are paid by the month and get pay and board, as the most feasible way of providing for their keep. In fixing wage scales for other employees the Secretary of the Interior and the Commission have sought to exercise as much economy as is consistent with providing fair living wages, and have sought not to enter into competition with local industries.

The pay of laborers and the earnings of contractors compare very favorably with the wages paid for similar labor in the United States. The pay of axemen and ordinary laborers in southwestern Alaska is fixed at $75 a month and board, and in the interior at $90 a month and board. For similar work the wages paid in the Pacific Coast States is from $45 to $50 a month and board.

Because of the exhaustion of appropriations, work on the railroad this winter will have to be considerably lessened, if not suspended. Otherwise there are no serious obstacles to continuing certain classes of construction work for the greater part of the year, especially along the southern end of the line. If appropriations are made available, for instance, it would be advisable and economical to grade a considerable part of the Matanuska branch during the winter season.

PLAN TO OBVIATE SLIDES

From Matanuska Junction to the coal fields the line follows practically for the entire distance the drainage of the Matanuska River. This stream for a considerable part of the distance is banked by cliffs of gravel and sand, in places a hundred feet high or more. To attempt to cut into these banks, in many places

Photo by Curtis & Miller

REINDEER HERD ON LOWER YUKON: ALASKA

The reindeer provides the Alaskan esquimaux with meat, milk, clothing, and transportation. It is one of the anomalies of our law that the reindeer herds are under the control of the United States Bureau of Education

Photo by Curtis & Miller

HYDRAULIC MINING AT DAWSON: CANADIAN KLONDIKE

"Men in the interior, to whom for years the near vicinity of vast deposits of precious and baser metals, unutilized, and unutilizable without transportation, has been a Barmacidean feast, still refuse to credit the statement that the railroad is coming" (see text, page 567)

Photo by Curtis & Miller

A FIELD OF RYE AT RAMPART STATION, ALASKA

"The little army of workmen on Uncle Sam's newest big job eat Chicago beef or occasional game of their own shooting, within sight of meadow lands and hillsides where future herds of sheep and cattle will graze, and busy farmers will plow and plant and reap to feed the workers in the cities and mining camps" (see text, page 567).

would invite slides of a similar nature to those creating serious difficulty at Panama (see page 569).

To avoid this danger it is proposed to build up the railroad embankment along the side of the river bed, against the cliffs, diverting the course of the stream with wing dams. As the Matanuska is largely fed by glaciers, its flow is at a minimum in winter, and, despite the short hours of daylight, much of the work of grading could be accomplished with fewer obstacles and at lower cost in the winter than in the summer.

Overland transportation of supplies and equipment, too, can be made more easily and cheaply in winter. The valleys and bottom-lands of southern Alaska are generally swampy. In summer men and horses sink into the morass at each step, while the difficulties of travel through new country are enhanced by the heavy herbaceous growth, which approximates tropical jungle undergrowth in density. Under these conditions pack-horses are practically the only means of carrying supplies excepting along constructed trails. In the winter, however, roads are easily broken in the snow, and transportation of any kind becomes a much simpler and cheaper matter.

EARLY OPENING OF COAL FIELDS DESIRABLE

Reaching the Matanuska coal fields with a railroad at as early a date as possible will not only encourage quick development, but also will open up a source of fuel for the use of the Commission in railroad operation and in construction work along the northern part of the line. The Matanuska fields furnish a high grade of bituminous coal which has been found entirely satisfactory for naval use. The coal of the Nenana fields, on the northern part of the railroad, is a high grade of lignite, which is expected to furnish cheap and excellent fuel for domestic and industrial use in the interior of the country, along the Tanana and the Yukon.

No attempt is being made to add to the cost of the road by elaborate or ornate structures. It is realized that the prime need is for a road that will as quickly as possible lay open the riches of Alaska for use and her lands to settlement.

THE NATION'S PRIDE*

By Franklin K. Lane, Secretary of the Interior

IN THE development of this continent, the discovery of its resources and their highest utilization, there is a fascination to the American which is superlative. It is indeed our life, and has called out the most sterling qualities in our character. Those foreigners who write of our country often engage in facetious if not scornful comment upon our bombastic manner of telling the story of our growth and of the things achieved or possessed. They fail unfortunately to see far enough into the secret of our pride.

To have taken the prize for the largest pumpkin at the county fair, or to have milled more ore in a day than any other mine, or to have built the highest dam in the world*—such things are to us adventures which make the game of opening a new country worth while.

* This article, which gives a wonderfully impressive survey of our national resources and opportunities, has been abstracted and especially revised for the National Geographic Magazine by Franklin K. Lane, Secretary of the Interior, from his report to the President for 1915.

* The Arrowrock Dam was completed two years ahead of time and for more than a million dollars less than the estimated cost. This dam was constructed to supply the lands around Boise, Idaho, with water for irrigation. The dam will bear the following plate: "Arrowrock Dam. Maximum height 348.5 ft. Height above river bed 260 ft. Thickness at base 240 ft. Thickness at top 15.5 ft. Length along crest 1,100 ft. Length of spillway 400 ft. Concrete in dam 585,200 cu. yds., in spillway 25,400 cu. yds. Capacity of reservoir 244,300 acre feet, 79,642,000,000 gallons. Construction authorized in January, 1911, by R. A. Ballinger, Secretary of the Interior, upon recommendation of F. H. Newell, Director, and A. P. Davis, Chief Engineer of the United States Reclamation Service. Designed and

XUM

No one would smile when told that a foreign army had made an unprecedented number of miles in a day's march, or had brought into action a gun of unrivaled caliber, or built a ship of unequaled displacement or power. These are the very things on which nations pride themselves as revealing their capacity, ingenuity, and resourcefulness. They make for national self-respect and self-confidence.

THE AMERICAN'S MISSION

And so it is with the American. His place in the scheme of things is to reveal to the world what can be done in the development of a new country, and every crop raised, every school-house built, every rail laid, every nail driven is evidence that the work he is sent to do is being done. Instead of being the petty boasting of a parochial-minded provincial, this spirit is of the very essence of the highest creative quality.

It is not a figure of speech to say that every American has it in his heart that he is in a small sense a discoverer; that he is joining in the revelation to the world of something that it was not before aware of and of which it may some day make use. Men work for what they think worth while, and if they find their joy in proving that land has coal, or will raise wheat, or that a refractory ore may be reduced at a practicable cost, and tell about it proudly, they may be serving themselves, but they are also serving the world.

The clerk in the store or the mechanic in a mill may not consciously engage in any enterprise which makes this appeal, but when he learns that the government of which he is a part has within the year opened a town on the shores of the North Pacific which now has nearly 3,000 inhabitants, and has driven a railroad nearly 40 miles inland toward the Arctic Circle on its way to the coal fields of the Matanuska and the gold fields of the Tanana, he has a feeling that he, too, is participating in the making of this new world. One might say that this was nothing more than sentimental pride. There is a truer and a more dignified word for this quality; it is the expression of the American instinct for improvement.

built under general direction of F. E. Weymouth, supervising engineer, Idaho district, with Charles H. Paul, construction engineer, in direct charge, and James Munn, superintendent of construction. Completed November, 1915, under the administration of Franklin K. Lane, Secretary of the Interior."

OUR IMAGINATION IS CHALLENGED BY DIFFICULTY

We have a passion for going into the unknown, for answering the puzzles that are put to us. Our imagination is challenged by difficulty. And the result has been a century of growth, which in its magic and in its largeness casts a spell upon the mind.

Some months since I sought to learn what I could of the assets of this country as they might be revealed by this department, where we were in point of development, and what we had with which to meet the world which was teaching us that war was no longer a set contest between more or less mobile armed forces, but an enduring contest between all the life forces of the contesting parties, their financial strength, their industrial organization and adaptability, their crop yields, and their mineral resources, and that it ultimately comes to a test of the very genius of the peoples involved. For to mobilize an army, even a great army, is now no more than an idle evidence of a single form of strength if behind this army the nation is not organized.

WE CAN BUILD A BATTLESHIP ENTIRELY FROM OUR OWN PRODUCTS

An army is no longer merely so many rifles and men, cartridges and horses; but chemists and inventors, mines and farms, automobiles and roads, airships and gasoline, barbed wire and turning lathes, railroads and weather prophets—indeed, the complete machinery of an industrial nation's life. And out of the reports then made these facts stand out:

With the exception of one or two minor minerals, the United States produces every mineral that is needed in industry; and this can be said of no other country. We produce 66 per cent of the world's output of petroleum, 60 per cent of its copper, 40 per cent of its coal and iron, and 32 per cent of its lead and zinc. Tin in small quantities is produced in Alaska and platinum in Oregon, Nevada,

and California, manganese in Virginia, Georgia, Arkansas, and California; but of these latter minerals, as of nickel and some others of less importance, our supply is altogether inadequate for our consumption.*

We can build a battleship, or an automobile (excepting the tires), a railroad or a factory, entirely from the products of American mines and forests. To replenish the soil, we have phosphorus in abundance; potash is known to exist in the deposits of Searles Lake, California, which, however, is not yet commercially available, and in alunite, where it is combined with aluminum, and deposits of which are found in several States; and nitrogen can be extracted from the air by cheap hydro-electric power, as is now done in Germany, Norway, and elsewhere; so that we can feed the earth and keep it sustained.

Our soil and climate are so varied that we can produce all the grains, fruits, vegetables, and fibers known to the Temperate Zone and some found in the semitropics. And to crown all these, we have water power that can be made to generate perhaps as much as 60,000,000 horsepower.

PUBLIC DOMAIN SHRINKING

The public domain is rapidly growing less, which means that it is being occupied and used. Of the two hundred and odd million acres left, 12,000,000 acres have already been classified as coal bearing, over 4,000,000 as probably carrying oil, and 2,600,000 as phosphate lands. The most valuable discovery made in recent years as affecting the public domain is that the semi-arid regions may become abundantly productive under dry-farming methods. The Territory of Alaska, containing perhaps 400,000,000 acres, is now the great body of public domain. It is heavily mineralized and is a land of unknown possibilities. One gold mine there has recently erected a mill of 6,000 tons daily capacity, with ore in sight to run this mill for 50 years.

The waters that flow idly to the sea could be made to support not less than 50,000,000 people if turned upon the land that otherwise will remain pasture land or altogether worthless. The demonstration has been given that the lands of little rain can be made more fruitful than those where the rainfall is abundant. Land and water we have; the problem of bringing them together is one only of money.

When the war in Europe shut off certain chemical supplies, one of our chemists, Mr. Rittman, found a new process, which has been given to the public, by which benzol and toluol, the foundation of aniline dyes and explosives, and gasoline may be made from crude petroleum. Mr. Parsons and Mr. Moore have devised and proved a process for the reduction of radium from carnotite ores.

* The adaptability and resourcefulness of American chemists and engineers has been proved during this war as never before. A few illustrations will point this fact: Barium salts, needed for a variety of purposes, were formerly imported in large quantities, although the raw material, barytes, occurs in extensive deposits in this country. We now manufacture these salts in California, Colorado, Illinois, Pennsylvania, New York, Tennessee, and West Virginia, the new industry not only meeting the domestic demand, but also furnishing large quantities of barium compounds for export, and we are substituting domestic barytes for the foreign material for all purposes.

The substitution of sodium cyanide for potassium cyanide in the treatment of gold ores to the extent of more than half a million pounds in Colorado alone illustrates how the potash shortage is being met throughout the mining States.

Tungsten, an absolutely essential constituent in high-speed tool steel, is being mined at more points than ever before to meet the special demand in the steel-working industry; a tin smelter has been erected to reduce Bolivian ores; cobalt, which is a recent and valuable acquisition to the family of steel-alloying metals, is now being produced in quantity sufficient to lower the market price; American antimony is quoted in the metal market for the first time, and from Alaska alone more antimony ore has been shipped this year than was ever before produced from American mines in any one year; cadmium, formerly imported, is now an article of export, and in other minor metals full independence of foreign supplies is being worked out. Practically all the crude platinum from Colombia and part of the New Zealand output is coming to the United States for refining.

The position of American zinc in the world market is most striking. In the first half of 1914 the exports from the United States were $100,000, in the second half $8,650,000; and in the first half of 1915, $11,963,000, or more than a 100-fold increase over the same period in 1914, and the increase continues.

Photo by Putnam & Valentine

WATERMELON PATCH AT INDIO, CALIFORNIA

"To have taken the prize for the largest pumpkin at a county fair, or to have milled more ore in a day than any other mine, or to have built the largest dam in the world—such things are to us adventures which make the game of opening up a new country worth while. No one would smile when told that a foreign army had brought into action a gun of unrivaled power" (see text, page 589).

LIST OF EPOCH-MAKING INVENTIONS BY PEOPLE OF THE UNITED STATES DURING THE LAST FIFTY YEARS

Invention.	Inventor.	Date.
Telephone	Bell	1876
Typewriter	Sholes	1878
Cash register	Patterson	1885
Incandescent lamp	Edison	1880
Talking machine	....do.	1878
Electric furnace reduction	Cowles	1885
Electrolytic alkali production	Castner	1890
Transparent photograph film	Eastman	1888
Motion-picture machine	Edison	1893
Buttonhole sewing machine	Reece	1881
Carborundum	Acheson	1891
Calcium carbide	Willson	1888
Artificial graphite	Acheson	1896
Split-phase induction motor	Tesla	1887
Air brake	Westinghouse	1869
Electric welding	Thomson	1889
Type-bar casting	Mergenthaler	1885
Chain-stitch shoe-sewing machine	French & Myers	1881
Single-type composing machine	Lanston	1887
Continuous-process match machine	Beecher	1888
Chrome tanning	Schulz	1884
Disk plows (modern type)	Hardy	1896
Welt machine	Goodyear	1871
Electric lamp	Brush	1879
Recording adding machine	Burroughs	1888
Celluloid	Hyatt	1870
Automatic knot-tying harvester machine	Appleby	1880
Water gas	Lowe	1875
Machine for making barbed wire	Glidden	1875
Rotary converter	Bradley	1887
Automatic car-coupler	Janney	1873
High-speed steel	Taylor & White	1901
Dry-air process for blast furnace	Gayley	1894
Block signals for railways	Robinson	1872
Trolley car	Van Depoele & Sprague	1884-1887
Harveyized armor plate	Harvey	1891

As compared with this list, note the following list of important inventions that have been made during the same period by foreigners, which has been compiled from information furnished by the 43 examining divisions of the Patent Office:

Invention.	Date.	Inventor.	Nationality.
Electric steel	1900	Heroult	French.
Dynamite	1867	Nobel	Swedish.
Artificial alizarene (dye)	1869	Graebe & Lieberman	German.
Siphon recorder	1874	Thompson	English.
Gas engine, Otto cycle	1877	Otto	German.
Wireless telegraphy	1900	Marconi	Italian.
Smokeless powder	1886	Vielle	French.
Diesel oil motor	1900	Diesel	German.
Centrifugal creamer	1880	De Laval	Swedish.
Manganese steel	1884	Hadfield	English.
Electric transformer	1883	Gaulard & Gibbs	Do.
Cyanide process for extracting metal	1888	Arthur & De Forrest	Do.
Mantle burner	1890	Welsbach	Austrian.
By-product coke oven	1893	Hoffman	Do.

XUM

An oil expert, Mr. Pollard, was put to the task of saving the billions of feet of gas wasting daily into the air from the oil wells of Oklahoma, and was successful. Mr. Cottrell has devised a method of taking solids and liquids out of smelter smoke, such as sulphuric acid, arsenic, zinc, and lead.

A NATION OF INVENTORS

During the past 50 years the people of the United States have uttered two-thirds of all the revolutionary epoch-making inventions of the world, ranging from the telephone and the incandescent lamp to Wright's aëroplane and high-speed steel (see page 593). Each day we issue an average of 200 letters patent to American inventors, and the number of inventions is increasing with the years.

There are over 20,000,000 boys and girls in the public schools of the United States.

THE ERA OF SPLENDID GIVING

These, then, are the assets of the United States as revealed in but this one department—lands and waters and mines, inventors and chemists and engineers, and a new generation coming on which will add still further to the adventurous annals of peace. What has been our policy with respect to these? How may they be the more highly put to use? These questions are seen to be more vital than ever before. And at the outset let me say that I find no need for a change of policy, but only for its expansion.

We have given of our resources as no people ever did before or ever can again. Within 50 years we gave in subsidies to our railroads public lands that exceeded in size a territory seven times as large as the State of Pennsylvania. We have given to the States, for the sustaining of their schools and other public institutions, an amount that our records do not accurately state; but this we know, that 13 western States were given over 67,000,000 acres.

In addition, the Federal government gave to the States all the swamp and overflowed public lands within their borders, amounting to 64,000,000 acres by roughest approximation, upon condition that they used the proceeds to reclaim the lands—a condition which it may be idle to state has been only in part complied with.

Every country has found itself in embarrassment at the close of a great war. From Rome under Cæsar to France under Napoleon the problem arose as to what could be done with the men who were to be mustered out of service. No such embarrassment, however, came to the United States at the end of the Civil War, for out of our wealth in lands we had farms to offer the million veterans—and better use was never made of any land. Even today this "soldiers' scrip" is recognized and is filed to secure choice bits of forest lands or power sites.

Indeed, the peoples of the world were called in and tendered homes, until now, out of an acreage within the United States of a full billion and a half of acres of public domain, we have left as public lands subject to disposal and homesteads and otherwise less than 280,000,000 acres,* not one-half of which, it may safely be said, will ever prove to be cultivable. There passed out of this office last year 61,979 patents to land, some for 160 acres and some for 320 acres—donations from the nation to the courageous pioneer.

The man who finds gold or silver or iron or lead or copper, or any other of the so-called metalliferous minerals, has it for the asking—a prize for discovery. We expend $1,500,000 a year now in the making of geological and other studies of the country that we may know what we have.†

GO FORTH AND FIND

And all the revenue from the sale of public lands (less 5 per cent, which goes

* When the grants to the States are satisfied this amount will be diminished by over 15,000,000 acres.

† As a utilization in most practical form of these studies there have been published during the past year four books of an original character—geological guide-books along the western railroad lines, one along the Northern Pacific, another along the Union and Central Pacific, a third along the Santa Fe route, and a fourth along the Southern Pacific coast line. These tell by map and picture in simple and untechnical language the story of the formation and character of the land through which the tourist is passing.

to the States) goes into a fund for the building of irrigation works to reclaim the desert.

Was there ever a more generous method taken of populating and developing a new land? Surely there has been no niggardliness on the part of the government, which has not asked from those who took its lands even so much as the cost of their administration.

In doing all this with so lavish a hand the government has been expressing the generous instinct of the people and their absorbing determination to "go forth and find." For a hundred years and a little more this quest has been the drama of our life. It has given color to our civilization and buoyancy to the hearts of the people. It has been a century of revelation, and as yet we have only the most superficial knowledge of what this land is, of what it will yield to research, and how it may best be used. Its development has only begun.

TO USE, NOT TO HOLD OR WASTE

But in all our giving we have been guided by a purpose—the land that we gave was to be converted from wilderness into homes, or from rock into metal. We gave to the States and to the railroads, with a reservation of minerals. We gave to the homesteader, with a condition—the land was to be used. We gave our swamp lands, but to be reclaimed. We found our coal lands going as farms and we put a price upon them. We saw our forests being swept clean or monopolized and we held them out from the mass. Use! Use by as many as possible! The superior use! These were the things we wished and these gave form to our legislation. No homesteader receives all the lands he wishes, or even all he might use. One hundred and sixty acres was the limit, not a full section. But now he may have 320 acres if it is dry farming or grazing land—and for the latter the size might still be increased.

And he cannot have it as a speculation. It must be made a home and brought into the body of the world's producing area by cultivation.

The government was generous, but it had no intention of being a spendthrift. When it found itself being imposed upon it stayed its hand and drew back. So it came about that lands were withdrawn from entry—the Alaskan coal lands, the oil and the phosphate lands, dam and reservoir sites for power plants, and a few water holes which commanded the adjoining miles of desert. The Nation stayed its hand and drew back, so as to make sure of the right course. It wished use—use by as many as possible and the best use.

And now we have come to a point where it can be said that if Congress will pass two bills now before it there will be no resource in reserve, of all its vast treasure in lands, save national forests and national parks.

A PROGRAM OF INTERNAL DEVELOPMENT

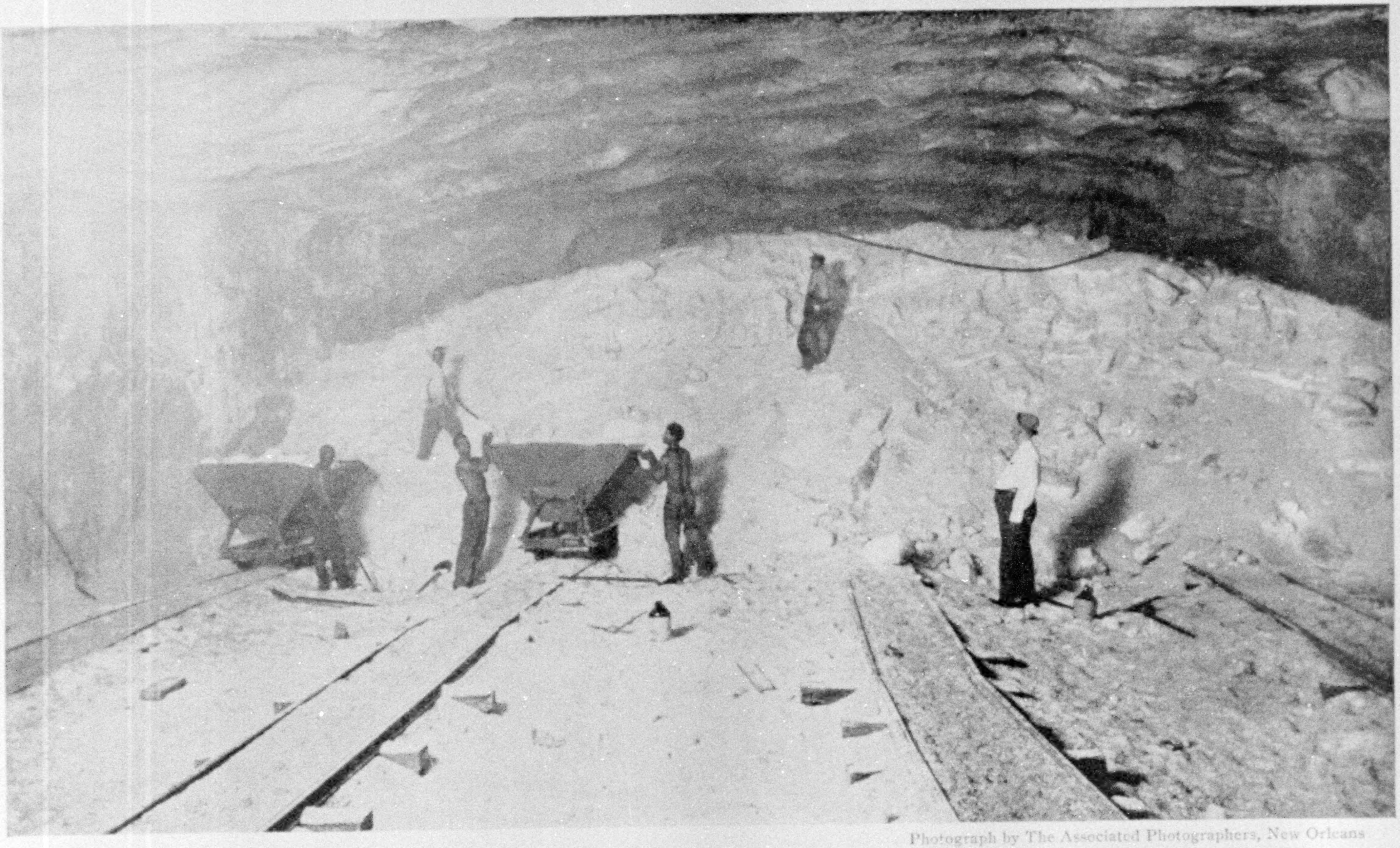
Two years ago I presented in my report* what might be termed a program of internal development with respect to land; a railroad into the interior of Alaska; a coal-leasing law for Alaska; a new reclamation act extending the time within which payments were to be made by water-users and under which land would be forced into use; a water-power bill governing the use of public lands for hydro-electric development; a general development bill providing for a practicable method of disposing of our oil, gas, coal, phosphate, and potash without danger of monopoly or non-use. Of this program the larger portion has been adopted, but the last two failed of passage in the Senate after having been successful in the House.

The plan is to make the West help in its own development. The royalties from oil, gas, coal, and phosphate lands and from water power developed on public lands should be used for the reclaiming of the arid country and then divided with the States.

PHOSPHATE ROCK "IN PLACE"

The need for the general development bill is not difficult to present. The lands of the Pacific coast are being used intensely in some parts, and these lands call for fertilization. One of the elements

* See National Geographic Magazine, February, 1914, pages 183-225.



Photograph by The Associated Photographers, New Orleans

IN THE DEPTHS OF A LOUISIANA SALT MINE

"With the exception of one or two minor minerals, the United States produces every mineral that is needed in industry; and this can be said of no other country. . . . We can build a battleship or an automobile (excepting the tires), a railroad or a factory, entirely from the products of American mines and forests" (see text, page 590).

which must be restored to the soil is phosphorus. This is native in most soils, but is needed by all after long use. The orange orchards of California and the apple orchards of Oregon and Washington, not to speak of others, draw heavily upon the soil.

And for its replenishing the orchardists are buying phosphate rock in Florida, which is carried 5,000 miles by water and then inland, while in Idaho, Montana, and Wyoming we have under withdrawal nearly 3,000,000 acres of lands that are underlaid with phosphate rock. There is no law today under which this can be secured. In Montana and elsewhere throughout the West are smelters which produce the sulphuric acid necessary for the conversion of this rock into practicable fertilizer; so that the development of this industry waits only upon the passage of a law which will put this mineral at the command of those who need it.

Our coal lands are now subject to sale at appraised values based upon an estimate of the content of the land. This is at best an expert's guess, and converts each purchase into a gamble, both on the part of the government and the purchaser. The bill does not exclude this method, but supplements it with a simple provision by which the purchaser, instead of buying at hazard, may pay a royalty upon what he produces. It gives the man of moderate means an opportunity to secure a mine.

THE OIL WELL AS A PLACER CLAIM

As to oil and gas, the House committee had extensive hearings at which no practical man engaged in the industry offered any objection to the plan proposed. The existing law, under which such lands have been taken up, is to be characterized by no politer word than as a plain misfit. Oil is found hundreds and sometimes thousands of feet below the surface of the earth, yet the law applicable to its acquisition is the placer law, intended to apply to the recovery of superficial minerals.

This law is of romantic origin, for it is the outgrowth of the experience of the Argonauts who went to California in the days of '49. The measures adopted by these men for the government of their claims along the mountain streams, where they did no more than lift the river sands to the pan or rocker, finally were incorporated into law; and the governing principle of this law was that before a man could claim ownership in a placer claim he must have found gold there; and until he did, others might, at their bodily risk to be sure, attempt to make prior discovery. The utter inapplicability of such a principle to a mineral found perhaps 2,000 feet below the surface, and where the discovery must be made at a cost of twenty, fifty, or a hundred thousand dollars, is clear beyond comment.

Now, under this impossible law a large amount of public land was "taken up," and by that is meant that it was located on and thereafter became a general basis for speculation, and sometimes was developed. That the law is as hazardous to the investor as it is unsatisfactory to the government is universally conceded, and in its stead should come a measure under which the government would give a permit at first—an exclusive permit for drilling — and upon discovery within a given time an area be given as a reward for proving the ground, and adjacent lands leased upon a royalty basis.

A PRICELESS RESOURCE BEING WASTED

There is another charge to be made against the existing law more serious than its unworkability. It is supremely wasteful. If the land is leased, some control can be exercised over the manner of development. Millions of barrels of oil have been wasted by being allowed to flow into the streams, by being mixed with water, or by evaporation. There has been no such waste, I am told, in any other mining.

And petroleum is a priceless resource, for it can never be replaced. Trees can be grown again on the soil from which they have been taken. But how can petroleum be produced? It has taken the ages for nature to distil it in her subterranean laboratory. We do not even know her process. We may find a substitute for it, but have not yet.

It is practically the one lubricant of the world today. Not a railroad wheel turns

without its way being smoothed by it. We can make light and heat by hydro-electric power, but the great turbines move on bearings that are smothered in petroleum. From it we get the quick-exploding gas which is to the motor and the airship what air is to the human body. To industry, agriculture, commerce, and the pleasures of life petroleum is now essential. Therefore to waste it is a crime.

An absolute government would prohibit a barrel of it being used for fuel before every drop of kerosene, gasoline, and other invaluable constituents have been taken from it.

How much of it there is in the United States no one knows. The Geological Survey has made a maximum estimate of twenty-three billion barrels, which sounds like an inexhaustible supply; but at the rate that it is now being consumed in this country alone (265,000,000 barrels a year) this does not mean an indefinite supply, and from the rapid exhaustion of some fields it is manifest that there can be no real approximation of the oil in our lands. Whatever the supply, it should not be allowed in its crude state to compete with coal as fuel, and the government should not promote its being wasted by applying to it archaic laws under which waste is a certainty.

TURNING WATER INTO POWER

When Benjamin Franklin caught the lightning on the tail of his kite he did a lot of strange things for this world, of which we are only beginning to learn. Among these are the uses to which flowing water may be put. The old-fashioned water-wheel, which was the motive power of our early industries, is now converted into a turbine which generates electricity, and this has as great a variety of uses as the muscles of a man's arm or a horse's shoulder.

Among the other strange things done by Benjamin Franklin was to give an added and peculiar value to the ledges of granite which confine our western streams and turn them into dam sites, useful for purposes of power generation. How many of these there are on public land not yet disposed of no one knows, but we have several hundred under withdrawal, which should be freed from withdrawal and turned into use just as quickly as possible; for, as the muscle of man or horse can raise a few barrels of water from the well to supply stock or irrigate the garden patch, so can the power of the stream, turned into electricity, be used to raise millions of barrels of water to irrigate alfalfa farms or orchards. And this is now one of the most common uses of electric power in the West, and, in fact, in some of the eastern States where irrigation is found of value.

The waters that flow down our streams are only a small portion of the rain and snow which fall. There are streams that follow their courses underground just as clearly marked and as valuable, if once discovered, as the streams above ground; and to tap these is a part of making America. Cheap gasoline is doing it in some places; cheap coal in a very few; but cheaper electricity is doing it in a large way.

GETTING SUPPLIES OF NITROGEN

Then, too, there is that mystifying miracle of drawing nitrogen from the air for chemical use, which can be done only with great power, but is being done in Germany, Norway, Sweden, France, Switzerland, and elsewhere, by which an inexhaustible substitute for the almost exhausted nitrates of Chile has been found. This is already a great industry in Europe, and will by necessity become greater in the United States than elsewhere, because of our size and need and opportunity.

To increase the yield of our farms and to give us an independent and adequate supply of nitrogen for the explosives used in war, we must set water-wheels at work that will fix nitrogen in lime. And there are still more intimate uses for this power. In places in Montana it is so cheap that it operates the churn, the sewing-machine, and the vacuum cleaner, and supplies light to the house and fuel to the kitchen range. Indeed, for the possible uses of electricity there is no measure.

Accompanying the general development bill in its passage through the House was a measure intended to pro-

mote hydro-electric development on public lands, named after the chairman of the Public Lands Committee of the House, Mr. Ferris. This bill was called for by the fact that existing legislation permitted only a revocable permit to be granted for such use, and this was regarded by engineers and financiers as too tentative and hazardous a tenure where millions of money were needed for the installation of the necessary plant.

THE PEOPLE WANT THE LANDS USED

The Ferris bill meets this difficulty by proposing a lease of these lands for a definite term of 50 years. The objection is made that the lands should be given outright. To this there are several answers of substance: No enlightened government gives such a franchise. There is danger—very real danger, too—of a complete monopolization of such power sites if the lands go forever from the people.

The value of water power is not yet fully realized, and its full value cannot be known at this stage in our industrial life. The purpose of the government in transferring these lands is to secure their use, because it does not choose to use them itself; but the time may come when it may be most desirable to the full development of our life that they shall be operated by the Nation or the States or the municipalities in the States, and to transfer them forever would cast a burden upon the future which would be unforgivable, and is, moreover, unnecessary. The people desire these lands used, not held as a mere basis for speculation in stocks or bonds. Where there is need for such a plant, the lands should be available on most generous terms.

At the end of the fifty-year period, if the plant has been so managed as to best serve the country, there would be no reason why the holding company should not have a new lease.

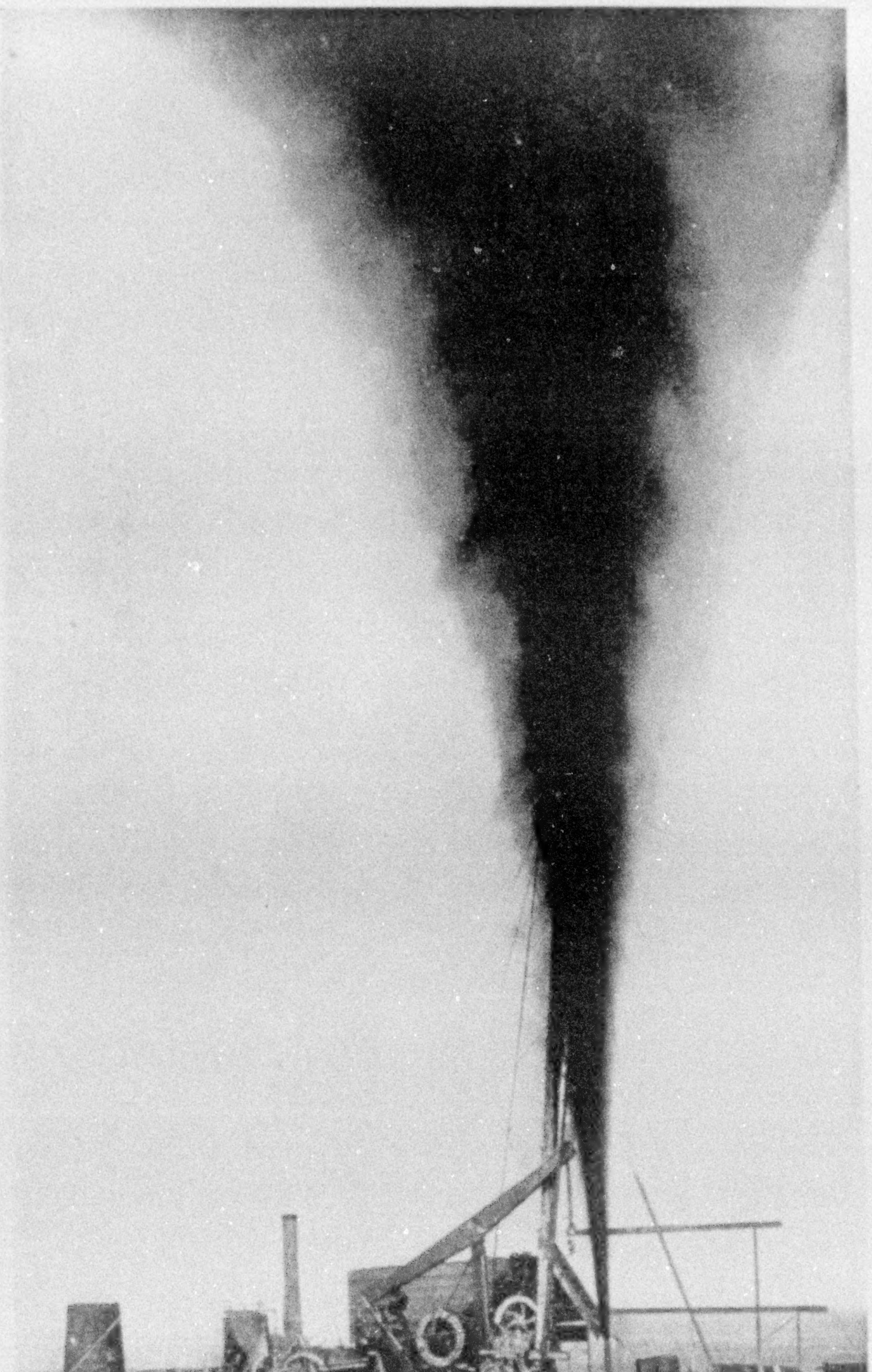
With the passage of these two measures (the general development bill for utilizing our oil, potash, etc., and the water-power bill) there will be no land or resource that will not be at the full service of the people; and yet the romantic enterprise of revealing America will not be done. To get from our resources their fullest use—this is our goal. And this is nothing less than a challenge to the capacity of a democracy.

There are many prosaic details involved in this quest. The mining men need a new set of mining laws, for instance. The old code is so elaborate and complicated that the best of brains cannot tell what the law is. The truth seems to be that between mining engineers and mining lawyers the rules of the game have been refined into obscurity. And if Congress were to say to the President that he might select three men familiar with mining laws and miners' difficulties to suggest a new mining code to Congress, it would, I believe, be giving in earnest a new freedom to the mining industry.

A LAND OF MYSTERIOUS CHARM

Then, too, there is the matter of the further development of Alaska. That land is a long way off. It would be too hazardous a thing to surrender these resources to local control or disposal, for those who have lived in any new country know how great the temptation is to grant away water front and power sites, forests, and other exceptional resources to those who come offering large sums for quick improvement. Yet this should not drive us into a policy that makes slow administration a necessity. The confusion in administrative action in Alaska is well known. I have tried to give it currency that it might hasten the establishment of some method of coördinated control of Alaskan affairs, primarily in the hands of a resident commission, but always in touch with and responsive to the wish of Congress and the President through one of the departments.

That land has a mysterious charm, a pull which affects all who see it, and those, too, who only know indirectly of its largeness, its grandeur, and its economic possibilities. This could not be better illustrated than by the number of applications for places which were received by the Alaskan Engineering Commission. When that body left for Alaska in the spring the number was over 38,000, and most of those who applied were not out



OPENING A GUSHER

"Petroleum is practically the one lubricant of the world today. No railroad wheel turns without its way being smoothed by it. Great turbines move on bearings that are smothered in it. From it we get the quick-exploding gas which is to the motor and airship what air is to the human body—therefore to waste it is a crime" (see text, page 597).

of work, but already held positions with railroads, in banks, on farms, or in some city shop. They wished a taste of the large life of this new land. There are many more of the same desire, some of whom will make Alaska richer by their presence and find happiness in searching out the land.

TAMING THE RIVERS FOR USE

No one can survey the physical condition of the United States without being impressed and almost overwhelmed with the magnitude of the work that must be done in keeping our rivers within bounds and putting them to use. It is the largest task that the government must undertake sooner or later, and the sooner, in my judgment, the better. This matter came immediately and most practically to my attention on a trip made in the late spring to the lower valley of the Colorado River. On the Arizona side of this river the government is reclaiming the desert. That lowland will grow almost anything, from dates to alfalfa. Its most helpful friend, and its unrelenting enemy, too, is the river itself, for without the river it would return to cactus and sage. Yet the river is so jealous of her freedom that she yearly attempts with violence, and by insidious methods as well, to reclaim for herself each foot of land that has by stealth been taken from her.

On the opposite side of the river, the California side, the river is held in by mountains, until it has reached the Mexican line. There, by a capricious turn, it deserts its old, accustomed channel and flows westward into what was once a lake, but is now little more than a morass, and so slowly finds its way to the Gulf of California.

Immediately north of this westward bend in the river is the Imperial Valley, which has lately been used by several novelists to illustrate the heroic struggle of man with nature; for this valley was once a sea itself, and has indeed left a sort of rudimentary sea in a lake known as the Salton Sea. The fruitful soil of this valley, hundreds of feet deep, is the silt of the Colorado, the deposited wash of a thousand miles of mountain channel.

Each June, when the snows of the Rockies melt, the Colorado, resenting the limitations which man has set up for it, presses with two strong shoulders against both sides of its prescribed banks, like Porthos under the slow caving of the earth. And as long as that flood comes the people on both sides must watch and work as the Hollanders have done.

CATCHING YOUNG WATERS

Now, far above this point of danger there are thousands of square miles of land that need but the water of the Colorado River to make them as fruitful as the lands of the San Joaquin or the Salt River Valley. We need to catch that water when it is young, soon after it has been born from the snows. There, in mountain valleys, it should be kept for a time and, as needed, led into the peaceful paths of usefulness. And on that problem the Reclamation Service is working. The difficulty is to find large reservoir areas.

This instance is cited to show how intimately the matter of flood control and of reclamation are bound together. The problem extends from sea to sea. When we come eastward, to the Missouri and the Mississippi, for example, we find that in their upper reaches the lands need the waters, while in their lower reaches the lands must be saved from the waters.

No one can take the yearly toll of lives lost and of property destroyed by the furious and unrestrained sweep of our rivers without realizing that the people of this country cannot regard themselves as owning this land, really possessing it, until they have brought these waters under subjection. And in doing this they will literally create new land by the millions of acres—lands that will support millions of people as against the thousands which live upon it today.

WHY SHOULD THE WHOLE BURDEN BE BORNE TODAY?

How these great works can be carried on calls for constructive thought, not merely on the engineering side, but more immediately upon the financial side, as to those ways and means by which the lands reclaimed shall be made to bear in some degree the burden of the expense. As to

XUM

Photo by National Geographic Society Alaska Expedition

IN THE ALASKAN GLACIER BELT

"That land has a mysterious charm, a pull which affects all who see it, and those, too, who only know indirectly of its largeness, its grandeur, and its economic possibilities. This could not be better illustrated than by the number of applications for places which were received by the Alaskan Engineering Commission. When that body left for Alaska in the spring the number was over 38,000, and most of those who applied were not out of work" (see page 599).

the funds which will be needed, they mount into such figures as to be staggering. And I can see no hope that this work will be adequately undertaken without the government advancing its credit and investing directly some of its own funds.

We are conducting this government from day to day out of current revenues. Only the richest of people could pursue such a policy. No private enterprise attempts it. No railroad system has been built that way. But few of the States now construct their highway systems out of the year's revenues. The permanent improvements which the whole people undertake are a legitimate charge against capital account, not against maintenance. A commission to devise the ways and means by which the States and private land owners and the National government can coöperate in paying for the work done seems to me a more needed body than one which will report upon engineering methods.

PLACES OF BEAUTY AS AN ASSET

In casting up the assets of the United States as a landed proprietor, I have made no mention of one of the most delightful of our national enterprises. To build a railroad, reclaim lands, give new impulse to enterprise, and offer new doors to ambitious capital—these are

phases of the ever-widening life and activity of this Nation. The United States does more; it furnishes playgrounds to the people which are, we may modestly state, without any rivals in the world. Just as the cities are seeing the wisdom and the necessity of open spaces for the children, so with a very large view the Nation has been saving from its domain the rarest places of grandeur and beauty for the enjoyment of the world.

It is the destiny of the national parks, if wisely controlled, to become the public laboratories of nature study for the Nation; and from them specimens may be distributed to the city and State preserves, as is now being done with the elk of the Yellowstone, which are too abundant, and may be later with the antelope.

If Congress will but make the funds available for the construction of roads over which automobiles may travel with safety (for all the parks are now open to motors) and for trails to hunt out the hidden places of beauty and dignity, we may expect that year by year these parks will become a more precious possession of the people, holding them to the further discovery of America and making them still prouder of its resources, esthetic as well as material.

OUR FOREMOST INDUSTRY

I turn now from young America, the land that is underdeveloped, to Young America, our twenty-two million school boys and girls; for these, after all, are our chief resource and our chief concern. Are we doing all possible to develop this resource?

If there is any one of our institutions in which the American people take undisguised pride and of which they feel justified in boasting, it is the public-school system, for this is "the greatest of American inventions" and the most successful social enterprise yet undertaken by any people. The United States maintains a Bureau of Education in this department, which, upon a small appropriation, collates as best it can the figures and facts which most inadequately tell the story of the growth and use of this most brilliantly conceived piece of governmental machinery.

The American people pay for the support of their schools almost as much as they do for the support of the entire Federal government; in round numbers, three-quarters of a billion dollars a year, which keeps an army of 600,000 teachers at work.

OUR LEAST PROGRESSIVE ACTIVITY

Education is indeed our foremost industry, from whatever point of view it may be regarded. Yet I am assured that it has made less progress than any of our other industries during the past 30 years.

With all the marvelous record of what the mind of a quick people may produce to make life happier and nature more serviceable, how little can be shown as our contribution to the methods of improving the mind and skill of the young! We have gone to Europe—to Italy, Switzerland, Germany, and Denmark chiefly—for the new methods with which we have experimented, and Japan has found a way to instruct through the eyes and hands that will make these very practical people still more distinguished.

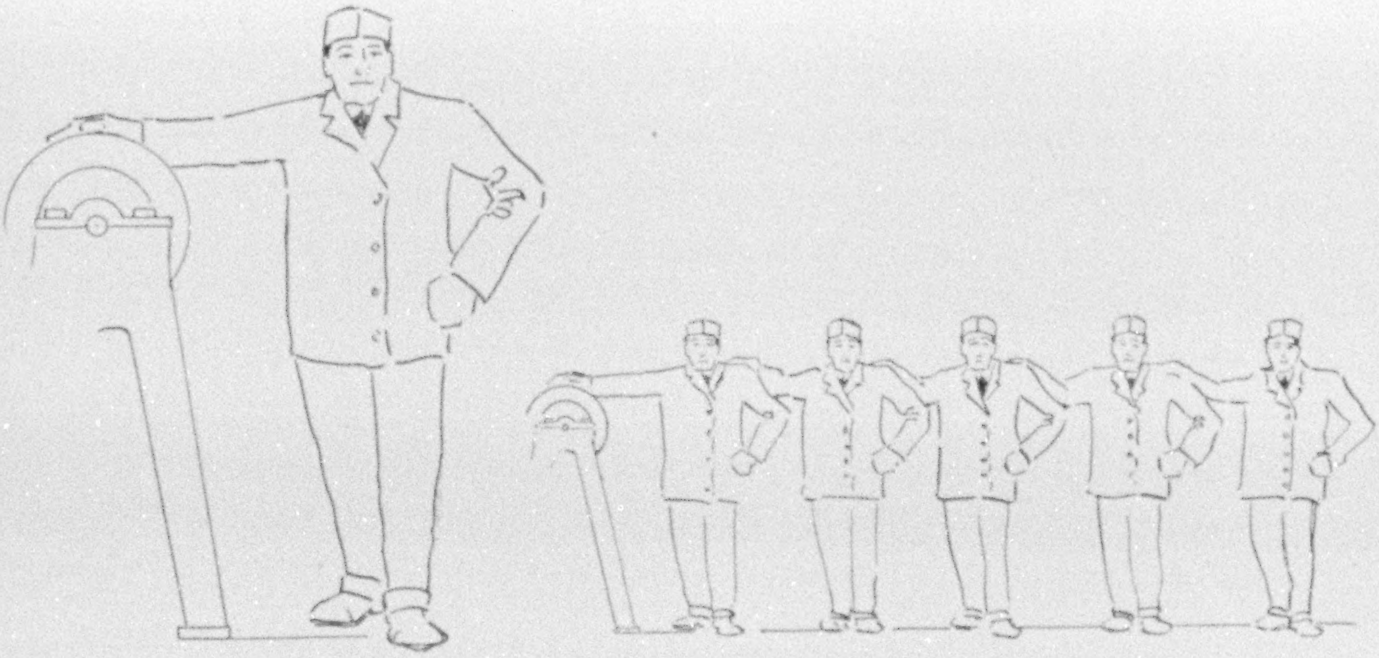
Yet here and there, under rare leadership, may be found in this country the most striking proofs of what can be done to tie our schools to our life. The hope is eventually to make the school what it should be, and easily may be made to be, the very heart of the community—social club and coöperative center as well as school.

There would seem to be nothing visionary in such a hope. To effect this evolution, there is needed primarily leadership, and this the government must give if it is to realize its desire for a people who are both skilled and happy.

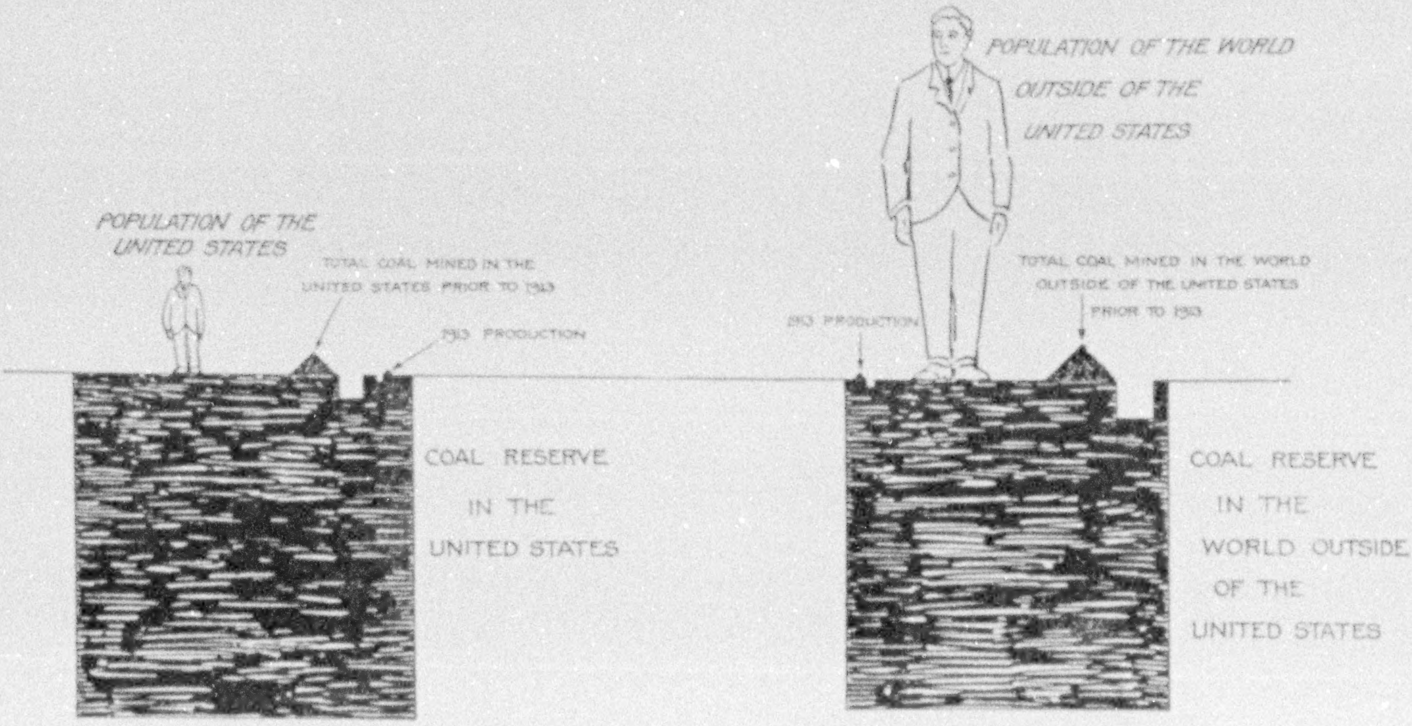
The spirit of our people is against a paternal government. We do not take with kindness to an authority that is mandatory. There is a sound belief that a people who make their own way are in the end riper and of stronger fiber than those who accept what is not the result of common determination.

A NATION "SHOWING HOW"

But this spirit of intense individualism does not make us independent of or indifferent to useful methods and helpful



One man with one metal cutting machine, equipped with tungsten "high-speed" steel tools, can now do as much work as could five men with five machines equipped with the carbon steel tools formerly used. These wonderful alloy steels, containing six or seven metals, have been largely, though not wholly, developed in the United States.



COAL RESERVES AND PRODUCTION IN THE UNITED STATES COMPARED WITH THE REMAINDER OF THE WORLD

standards; and it is these that we can reveal. It is these that we should find and place in service, rather than force the disconnected schools of the land to feel their way out or "muddle through." We may not command, but we may "show how." This is democracy's substitute for absolutism in the effort to secure efficiency.

For such policy of helpfulness there is abundant precedent, not only in the action of Congress in making minor appropriations for the work of the Bureau of Education on precisely these lines, but in the activities of other departments.

The country is dotted with experimental farms, which prove soil values, and the farmer of today is learning from the government how great and all-embracing must be the knowledge necessary to the carrying on of his work; for he must know of chemistry, mechanics, markets and finance, transportation, and a world of things which his father or grandfather would have laughed at as the frills of a doctrinaire education, notwithstanding the early example of the wise and many-sided farmer who was the first President of this country.

As in the Bureau of Mines, we seek to save the lives of miners by educating them in the use of explosives and life-saving apparatus, and by instructing operators in safe methods of building their vast underground workshops, so I would erect the Bureau of Education into a Bureau of Educational Methods and Standards in which would be gathered the ripe fruit of all educational experiments upon which the schools of the country could draw. This is a wide country, and there is need for a national clearing-house where can be centered and exchanged the results of the most remote experiments.

NO MORE MODERN THAN A WOODEN PLOW

There is no disguising the fact that we have a most difficult problem in the United States—and I cannot believe it is ours alone—in the rural community. A majority of our school children are in rural schools. The query arises: Are our rural schools doing their part in making life in the country desirable? An ambitious people will go where education can be had for their children. There is no sense in talking of the charms of country life and the independence and dignity of producing from the soil if the school at command is no more modern than a wooden plow.

The old-fashioned one-room schoolhouse which holds 40 or 50 ungraded pupils, having but a single teacher, who knows nothing but books, is not a modern institution, though great men have issued from its door. It may be all that the county can afford where many schools are maintained, but it is not all that the county can afford if schools are grouped and grades instituted.

The richest State in the Union has over 4,000 schools of this character, wherein the teachers are paid less than competent farm hands; and this brings to mind the correlative thought that one needed reform in the school system is in the elevation of teaching into a real profession, as in older countries. As it is now, a teacher is almost without status in our society.

How can the schools of a county be so coördinated and combined as to make them efficient tools? What should be the standard for a teacher's qualifications? How may children be brought to and taken from the school to distant homes at the least expense? To what extent should the teaching be out-of-doors and the "examples" those of real life?

How can the boy learn that there is adventure in farm life as well as in the city?—for adventure he will have. To what uses may the school building be put as a community center for the neighborhood dance, lecture, or moving-picture show, or, perhaps, as the home of a coöperative buying or marketing organization?

These are but a few of the questions which many men have tried to answer, and there have been some successful experiments made and right answers given.

A RURAL REVOLUTION

But it is as hopeless a task for a local school board to find these answers as for a lawyer to know the decisions of all the courts. The teachers, the superintendents, and the school boards need leadership; they need an authoritative statement of conclusions by the wisest and most practical men in the land; they need

to be shown the better way. And with even as little as a hundred thousand dollars a year for two or three years we could, I believe, conduct a campaign for a new kind of rural school that would work little less than a revolution in rural life.

Our aim would be to identify the school with the farm and the village and develop a new respect in fathers and mothers for the school as a practical and not a mere scholastic institution. The problem is only one of popularization. The experimental work has been done. We know where the best seed is. The need is immediate, and surely it would be a shame to let a generation waste itself while the idea slowly creeps on all fours through a country that has invented wireless telephony.

THE TEST OF A DEMOCRACY

There is an evolution in a new nation's life quite as interesting as that in the life of a man. We pass through stages of development from the simple and earlier period, when food is the one thing desired, into the more elaborated and complex stages, where first we begin to deal with the easily handled things and later reach the point where mind has a controlling part in all that is done.

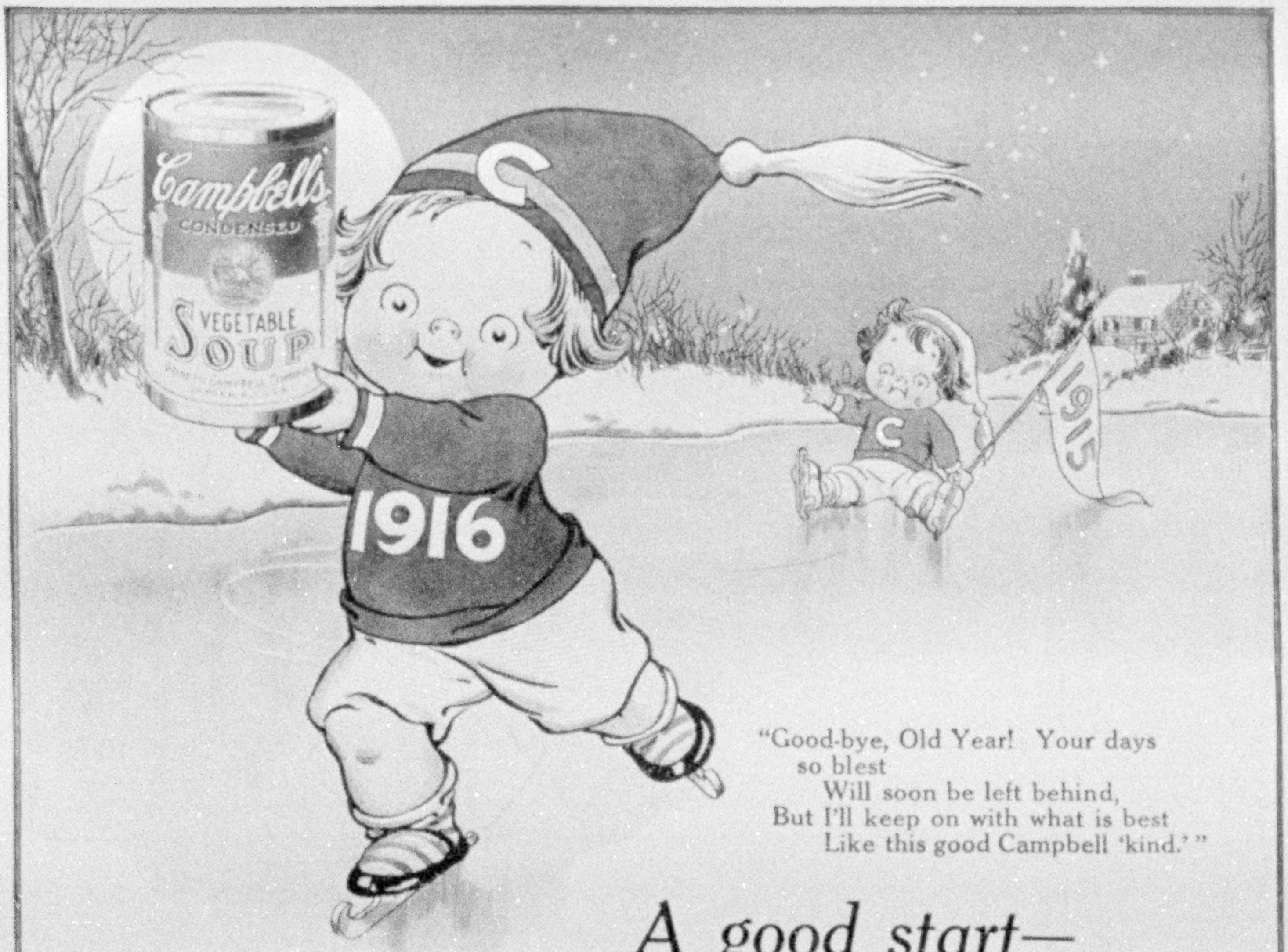
The pioneer builds his cabin and turns his cattle to graze upon the unfenced wilderness. He takes his water from the stream and makes his gun serve him with food and give him protection. It is not many years, however, before he has passed from herdsman to farmer, when soil must be plowed and seed sown. At first the one-horse plow will do and any seed. But life grows more intense—society has gathered around, new demands are created—machinery must be used, seed must be selected, soil fertilized, credit obtained, markets sought, and the life of the simple herdsman has become complicated and broad. The gay recklessness of other days gives way to constant thought.

So has it been with this country. For a long time we lived off the country's obvious supplies. Later we were producers of raw materials—grains and minerals, lumber and cotton. When manufacturing began it was of the larger, coarser things, which perhaps in their turn went abroad for higher fabricating. Now, however, we have come into the full tide of modern life, when we seek for greater and more varied industries, wider markets, more economical methods of production and exchange. And in such a new time direction is needed, mutual and coördinated effort must be set up, and the more elaborate machinery of organization put into service. Thought becomes the basis of the new life—hard, close, insistent, constructive thought, illuminated by knowledge and made practical by imagination.

COÖRDINATION NEEDED

I have reviewed some of the activities of this department that they may suggest how adequate to the task of efficient national development a democracy, even one so young, may be made to be. It has a foundation in the spirit and self-confidence of its people which no other government can have. There is needed but the crystallizing touch of coördinated action to make its success complete. To develop methods by which the energies of many individuals shall be brought to work together is the need; and as the method of doing this politically has been found in this Republic, so we may feel assured that economically and socially we shall not fail.

An intense nationalization has been the marking note of the past year. Each American has realized with keener consciousness the meaning of this land to him, and has sought for a larger view of it in its many aspects and, if possible, to gain a glimpse at its future. To each has come his dream. We know now that there is more to national feeling than pride in the possession of a land that is rare and valuable or the splendid memory of a history of struggle for those things of the spirit which men call principles. The highest sense of nationality comes with a sense of purpose—a sense of common purpose—for the United States is not yet ours in the proudest sense, and cannot be until we are doing all that can be done to give to all its people and to the world the full expression of its highest intelligence applied alike to its resources and to the life of the people.



"Good-bye, Old Year! Your days so blest
Will soon be left behind,
But I'll keep on with what is best
Like this good Campbell 'kind.'"

A good start—

Can you beat it? Can you do better for the New Year than "hold fast that which is good"? Think what a wholesome, high-efficiency food product you have in

Campbell's Vegetable Soup

With its rich condensed stock—made from selected beef—this nourishing soup also contains such substantial ingredients as carrots, white potatoes, sweet potatoes, small peas, "baby" lima beans, tender corn, green okra, tomatoes, and other choice vegetables, beside celery, "alphabet" macaroni, and parsley. A soup as delicious and satisfying as you ever tasted.

Try it again today and you'll realize this more than ever.

21 kinds 10c a can

Campbell's SOUPS

LOOK FOR THE RED-AND-WHITE LABEL

Protect Our Good Name

GOODYEAR
AKRON

Visitors to the Goodyear factories are always impressed with a framed sign which confronts them at every turn.

In every room in every Goodyear building, they encounter the same message: *Protect our good name.*

It hangs on the walls of all the Goodyear branches throughout the country, and is being adopted by tire dealers everywhere as an expression of the spirit in which their business is conducted.

We believe that the public will be interested in the analysis of this simple but striking sentiment which is published herewith.

The Goodyear Tire & Rubber Co.
Akron, Ohio

President

STRIPPED to the waist, his huge torso streaming with sweat, a workman swings the heavy iron core to an iron table, and wrenches off a tire which has just come steaming from the heater.

His eye falls on the legend over his head, and he smiles.

Our good name is also his good name.

The two are intertwined.

He will protect the one while he subserves the other.

His thoughts are—as they should be—chiefly of himself, of his little home, and of his family.

Their good name, his good name, our good name—his good work will stand guard over them all.

* * *

Two thousand miles away—in Seattle, we will say—the same thought, in the same simple words.

An irritating moment has arrived—the temptation to speak sharply to a customer, to fling a slur at unworthy competition.

The salesman, or the manager, or whosoever it may be, looks up, and the quiet admonition meets his eye.

Protect our good name.

In a twinkling it smoothes the wrinkles out of his point of view.

He is himself again—a man with a responsibility which he could not escape if he would; and would not, if he could.

Back two thousand miles again to the factories—this time to the experimental room.

An alluring chance to save—to make more profit by skimping, by substitution. No one will ever know. But—the silent monitor repeats its impressive admonition.

Protect our good name.

What chance to compromise with conscience in the presence of that vigilant guardian?

* * *

Thousands of men striving to keep a name clean.

And keeping their own clean in the process.

* * *

We Americans, it is said, make a god out of business.

Let the slur stand.

Whether it be true or not—it is true that business is our very life.

Shall it be a reproach to us that we try to make business as good as it can be made?

* * *

Think of *this* business, please, in the light of its great animating thought:

Protect our good name.

We are thinking of you, always, when we say it—you American millions, and you millions in the old world.

We think of you judging us, judging us—by what we are, by what we do, by what we make.

We think of tens of thousands of homes in which our name can be made to stand for that which is worthy and worth while.

We must not lose your good will—we must not tarnish our good name.

* * *

You can call that anything you like.

You can call it business, or sentiment, or idealism, or nonsense.

It may be all of these.

It may even be that which our national critics call making a god of business.

But at least it gives to us a motive that is bigger and broader and deeper than money.

It makes thousands of men happier in their work and more faithful to it.

It has made of this business a democracy of united thought—a democracy of common endeavor — a democracy of purpose and principle.

* * *

And here is the oddest thing of all:—

The more we live up to this "impractical" ideal, the greater the business grows.

The more we labor for the future, the more we profit in the present.

The more we strive for character, the greater the reward in money.

The more we put into our product, the more we take out in sales.

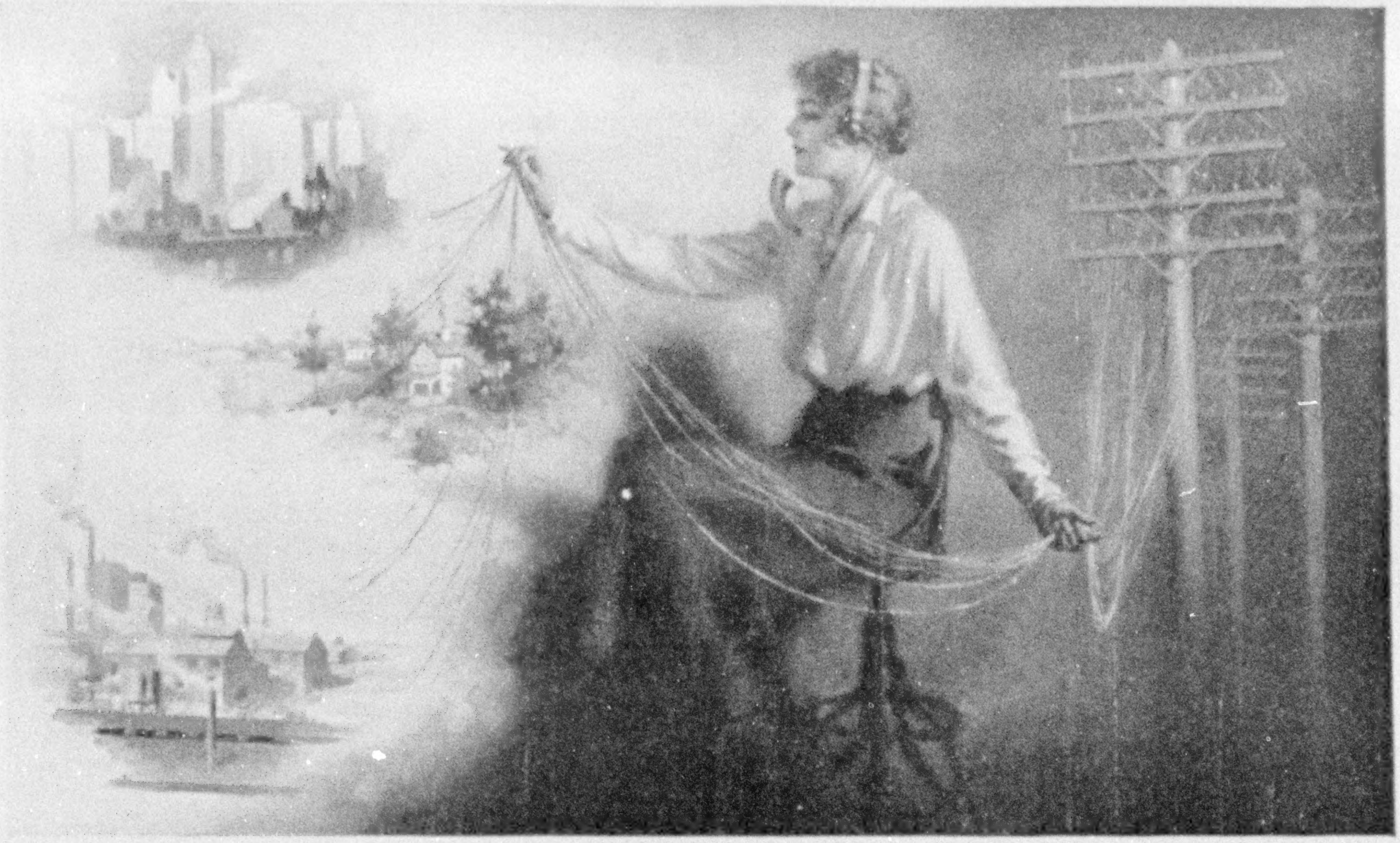
Perhaps, after all, there is more than one sense in which it is good to make a god out of business.

We think so.

And we think you think so.

, President

The Goodyear Tire & Rubber Company



Weavers of Speech

Upon the magic looms of the Bell System, tens of millions of telephone messages are daily woven into a marvelous fabric, representing the countless activities of a busy people.

Day and night, invisible hands shift the shuttles to and fro, weaving the thoughts of men and women into a pattern which, if it could be seen as a tapestry, would tell a dramatic story of our business and social life.

In its warp and woof would mingle success and failure, triumph and tragedy, joy and sorrow, sentiment and shop-talk, heart emotions and million-dollar deals.

The weavers are the 70,000 Bell operators. Out of sight of the subscribers, these weavers of speech sit silently at the switchboards, swiftly and skillfully interlacing the cords which guide the human voice over the country in all directions.

Whether a man wants his neighbor in town, or some one in a far-away state; whether the calls come one or ten a minute, the work of the operators is ever the same—making direct, instant communication everywhere possible.

This is Bell Service. Not only is it necessary to provide the facilities for the weaving of speech, but these facilities must be vitalized with the skill and intelligence which, in the Bell System, have made Universal Service the privilege of the millions.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY
AND ASSOCIATED COMPANIES

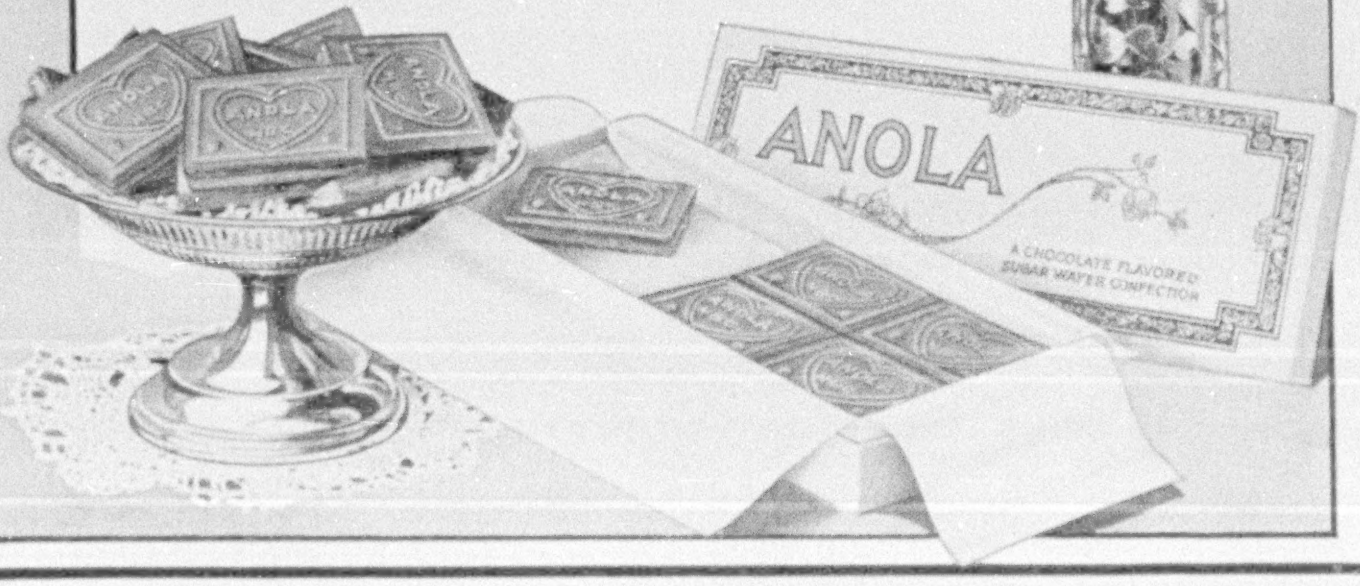
One Policy — *One System* — *Universal Service*

ANOLA

—the new dessert confection for all occasions. Taste one—you're delighted; try another, and another, until they're all gone. Crisp, chocolate-flavored sugar wafers enclosing a delicious chocolate-flavored cream filling. In ten-cent tins.

FESTINO—Dessert confections that are really almonds in shape and flavor.

NATIONAL
BISCUIT
COMPANY



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Living the Past in Present Day Comfort
Same tropic seas, furrowed by pirate galleys; the same brilliant sunshine on coral strands, stately palms, and cities of a bygone day.
Think of enjoying these visions of pirate days, of treasure trove, in restful ease—surrounded by every comfort that lets you enjoy the romance and history of the Spanish Main.
Sail Southward on Great White Fleet Ships, built especially for tropical travel; cool air forced into every room; spacious decks; all outside rooms, many with baths. A la carte service on New York Ships.
Cruises from 15 to 25 Days to
CUBA, JAMAICA, PANAMA CANAL, CENTRAL and SOUTH AMERICA
Sailings of GREAT WHITE FLEET Ships from New York every Wednesday and Saturday and fortnightly on Thursdays. Sailings from New Orleans every Wednesday, Thursday, and Saturday. For information write to
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UNITED FRUIT COMPANY STEAMSHIP SERVICE
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Write for Our New Book "CRUISING THE CARIBBEAN"
A story with illustrations about the Pirates, Buccaneers, and Marooners of the Spanish Main—Sir Henry Morgan, Captain Kidd, Teach, "Blackbeard" Lafitte, and others.
Connections at Colon for all Central and South American West Coast Ports.
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Colonel Dixie Plays Santa Claus

"I know I can depend upon it"

"Oh dad! It is too beautiful for words! Such color, such lovely, dreamy lines, such nestling upholstery, such gorgeous lamps! I'll just have to pinch myself to prove that Santa Claus and your dear old self are not playing a trick on my fancy."

"The only trick in it, daughter, is the trick I played on Santa Claus himself. He, like you and thousands and thousands of others, admires cars on their superficial appearance.

"Every motorist should go further, as I did, and investigate the ignition system, which is the most vital detail of any automobile. I would not tolerate his 'just as good' argument for a cheaper system, but insisted upon magneto ignition—

"The magneto makes the car go."

DIXIE Magneto 20th Century Ignition

"I know I can depend upon it—you'll be safe with it. I'll not have to worry when you are touring or shopping, because DIXIE ignition is a guaranteed *ignition certainty.*"

SPLITDORF ELECTRICAL CO.
Newark, N. J.

Resinol Soap

gives natural beauty to skin and hair

Resinol Soap is not only unusually cleansing and softening, but its regular use gives to the skin and hair that *natural* beauty of perfect health which even the best of cosmetics can only imitate. Pimples, redness and roughness disappear, and in a very short time the complexion becomes clear, fresh and velvety.

The soothing, restoring influence that makes this possible is the *Resinol* which this soap contains and which physicians have prescribed for years in Resinol Ointment, in the care of skin and scalp troubles.

If the skin is in bad condition through neglect or an unwise use of cosmetics, apply a little Resinol Ointment and let it remain on for ten minutes or so before washing with Resinol Soap.

Resinol Soap is sold by all druggists and dealers in toilet goods. For a trial size cake and miniature box of Resinol Ointment, write to Dept. 7-A, Resinol, Baltimore, Md.

Resinol Shaving Stick also contains the Resinol medication, making it most agreeable to men with tender faces. Trial on request.

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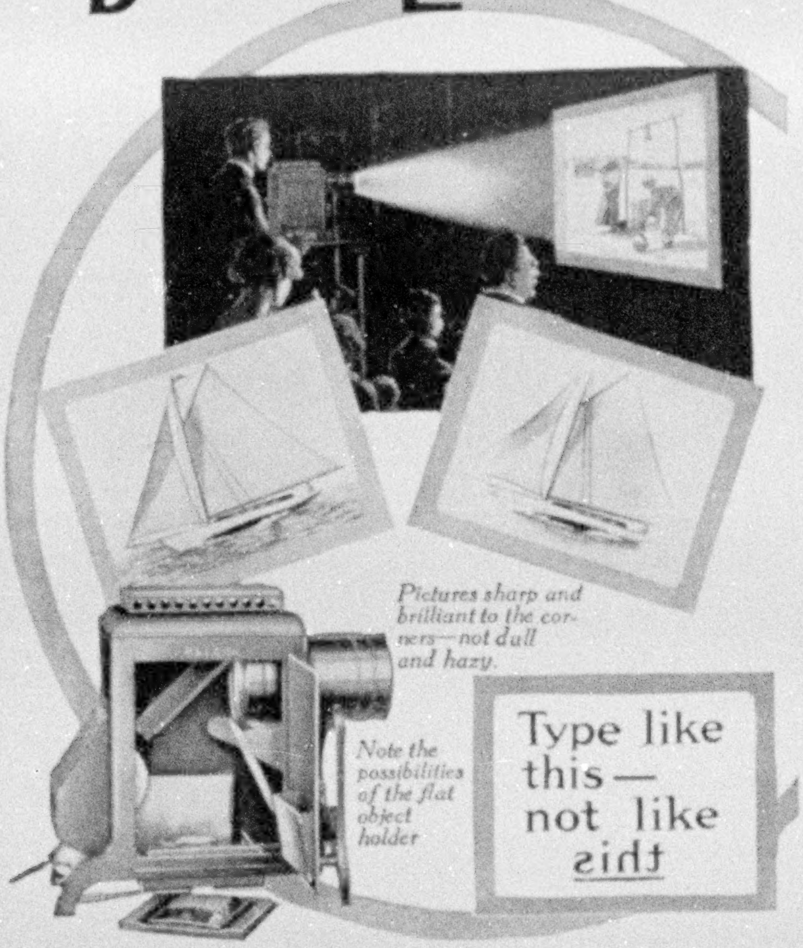

The pleasure and instruction which the ear gets from the talking machine, the eye gets from pictures and other objects shown by the

HOME BALOPTICON

made primarily as a projector of post cards, photographs, and various objects.

Special *400-watt, gas-filled Mazda lamp* with optically corrected mirror gives an illumination superior to anything heretofore offered, attaching to ordinary lamp socket.

Automatic, perfectly safe and simple enough for any child to operate. Fitted with high-grade achromatic lens, giving well-defined pictures sharp to the corners. Ideal equipment for clubs and small classrooms, as well as the home—not a toy.

Price for Home Balopticon complete for the projection of post cards, including aluminum coated screen, only **$35.** Sold by optical and photographic supply dealers. Other models to meet any requirement, **$20** and up.

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No. 127 Donegal Fleece Rug. Very smart, novel effect. Shaded from Black to White or Dark Brown to White; a great favorite. $15.00.

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Imported from Ireland as frequently as possible. Woven of pure long fibre wool on hand looms in slow Old World fashion.

Wide variety of patterns and colors besides many of the Scotch Clan Tartans. Minimum size 60 x 72 inches, not including fringe—many larger. Price, $15.00.

Many of the good shops carry Donegal Rugs. If your dealer cannot supply you we will. Rugs sent on approval. Absolute satisfaction guaranteed.

Shipments are infrequent, so it is desirable to order at once.

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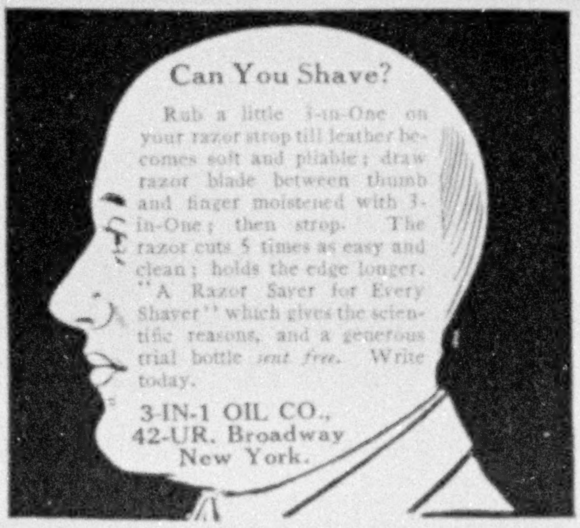

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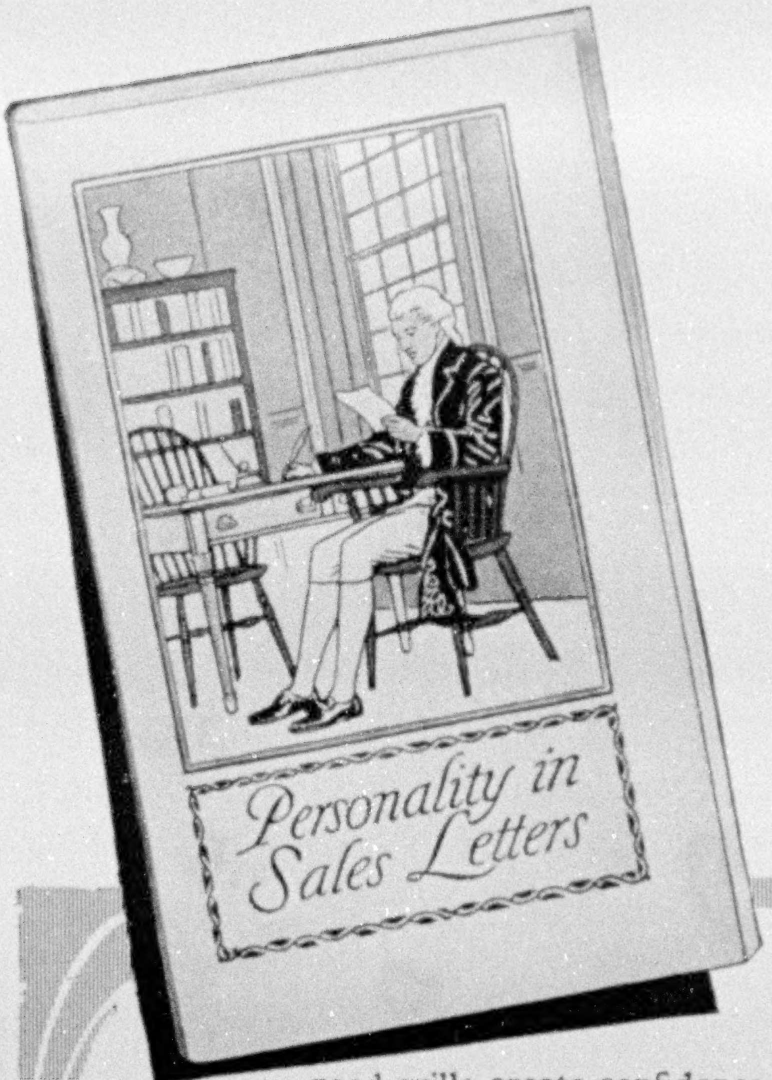
Don't blame the razor if it dulls quickly. Maybe it's your fault. Rub a few drops of 3-in-One oil on your razor strop. When leather is pliable strop as usual. Any razor will cut easier, better, and stay sharp longer. After using, draw blade between thumb and finger moistened with 3-in-One.

This prevents rust, keeps edge smooth and keen, always sharp and ready for immediate use. Don't *scrape* your face. Use 3-in-One on your razor and shave right.

FREE Write for liberal free sample and special *scientific circular.* Try it yourself. 3-IN-ONE OIL COMPANY. 42-UR, Broadway, New York.

"Mention the Geographic—It identifies you."



Every Writer of Business Letters Should Read this FREE BOOKLET

Men judge you by your letters. Letters may build reputation, good-will; create confidence, establish prestige—or the reverse.

A letter may be a dangerous thing, or a great, powerful, business-building force. At no stage in the growth and expansion of any business is the letter an inconsiderable factor.

"Personality in Sales Letters" will prove a real help to the man interested in increasing the efficiency of his correspondence. It is offered without obligation by the makers of

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We believe that as the realization of the importance of letters grows, the necessity for their faultless presentation will be more apparent. It has been observed that men who take letters for granted, so to speak; who take little or no pride in them, find small incentive to use Old Hampshire Bond. Users of Old Hampshire Bond, the standard paper for business stationery, are almost invariably those who are fully conscious of the part letters have played in the success of their enterprises. Users of Old Hampshire Bond are generally men who know.

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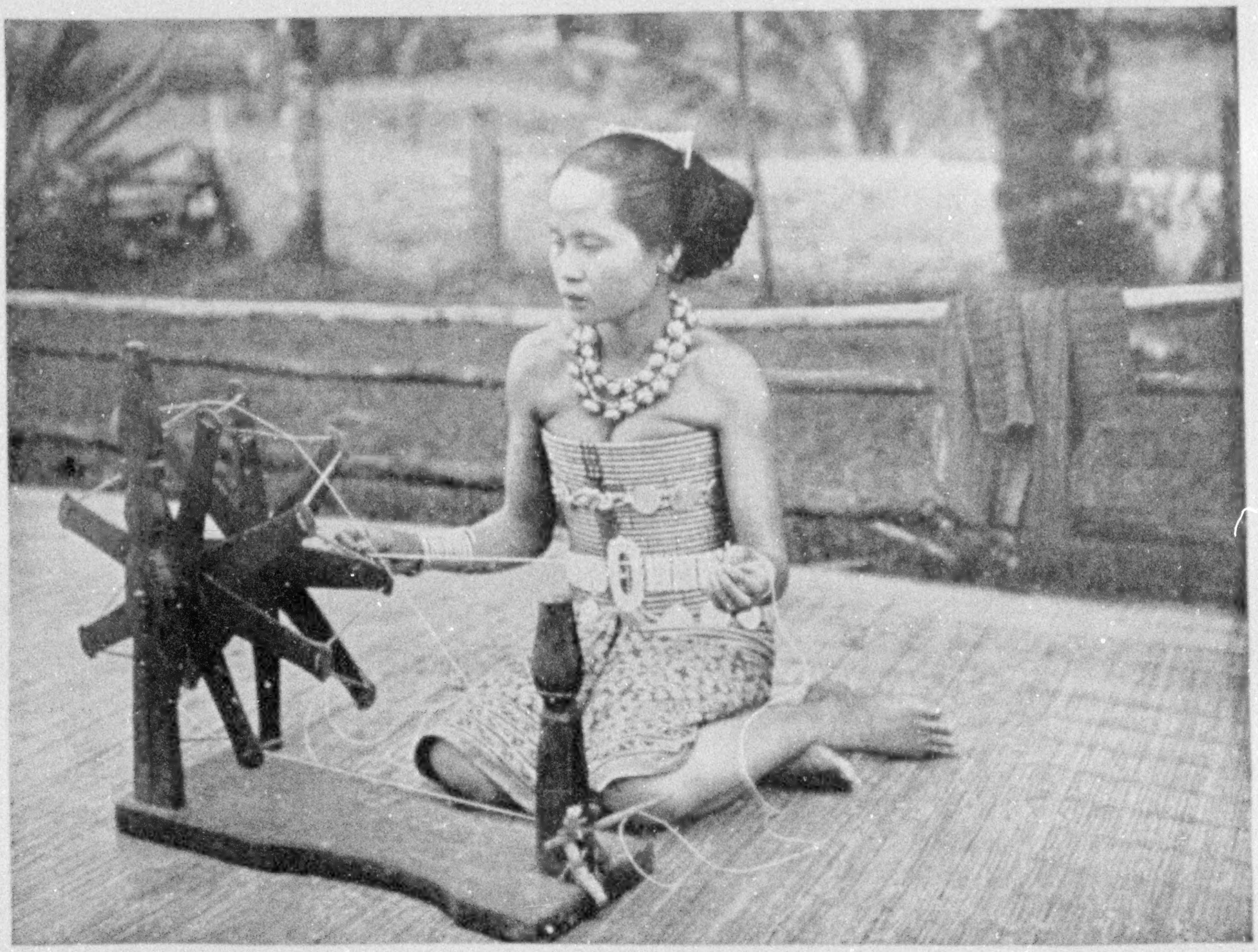

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for which I enclose herewith ______ dollars.

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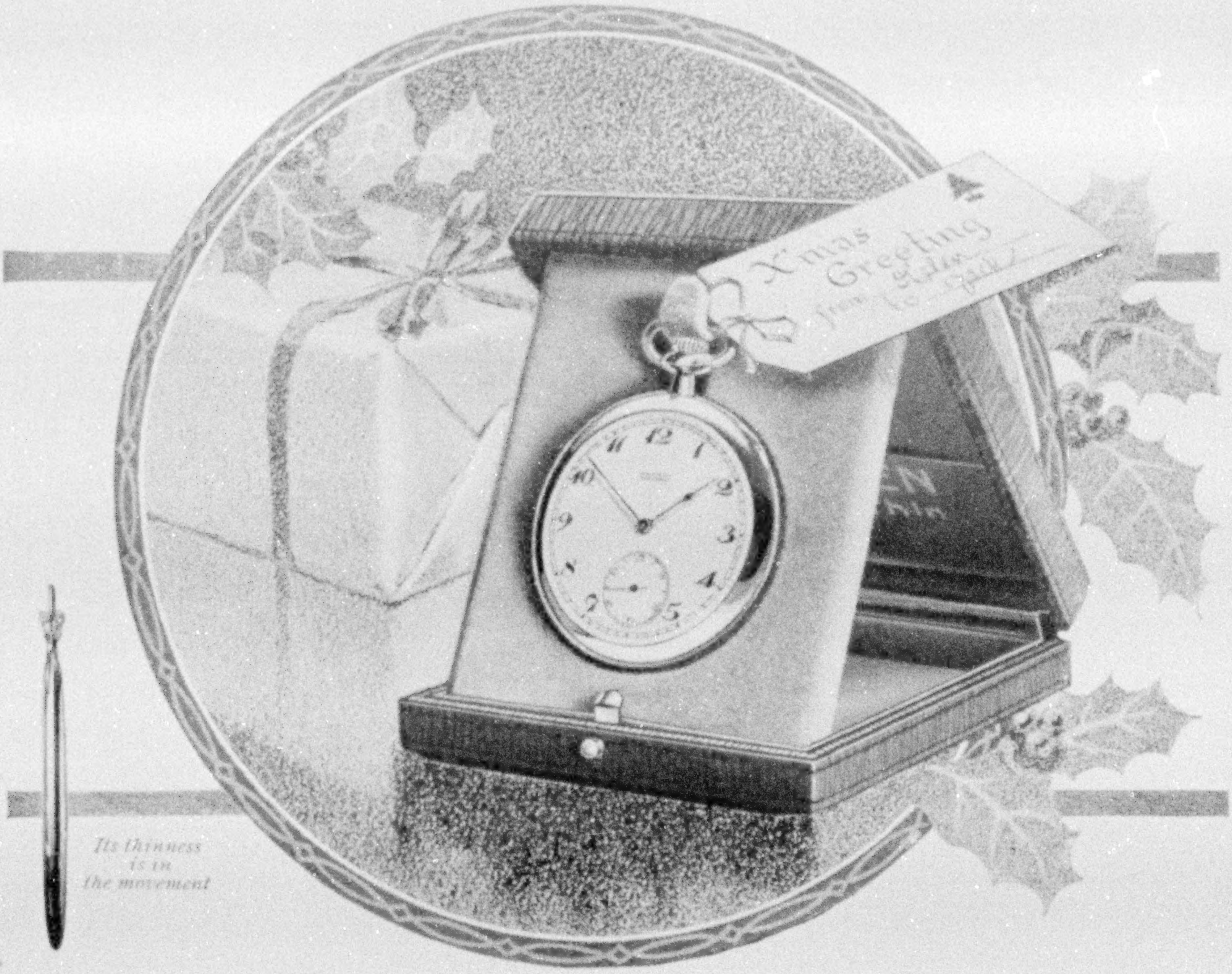

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At good jewelers everywhere.

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Duplicate parts to be had promptly through Gruen dealers everywhere.

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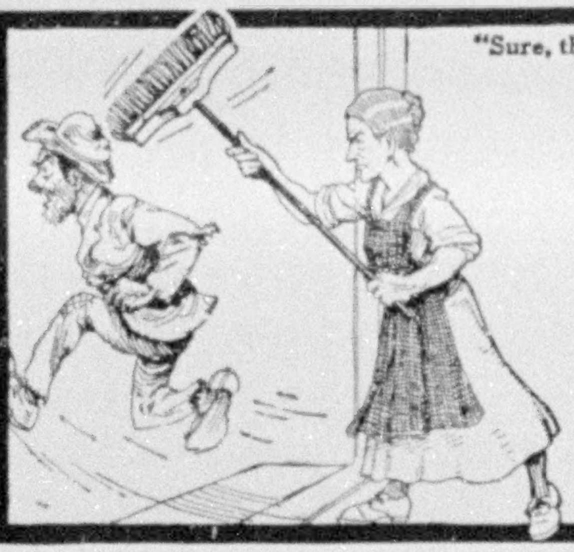
How the Gruen Verithin is made to "fit your pocket like a silver dollar," yet retain full size and strength of parts.



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which are guaranteed to live long and please all users
Over 10,000 Kinds and Sizes made

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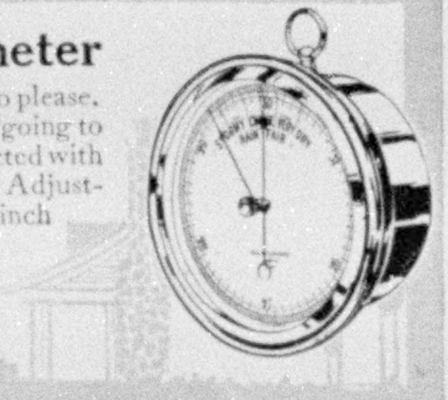

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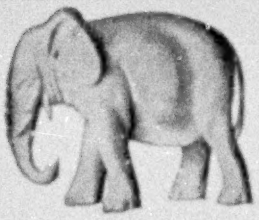

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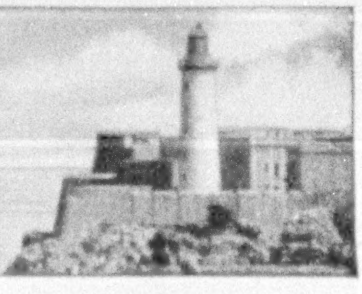

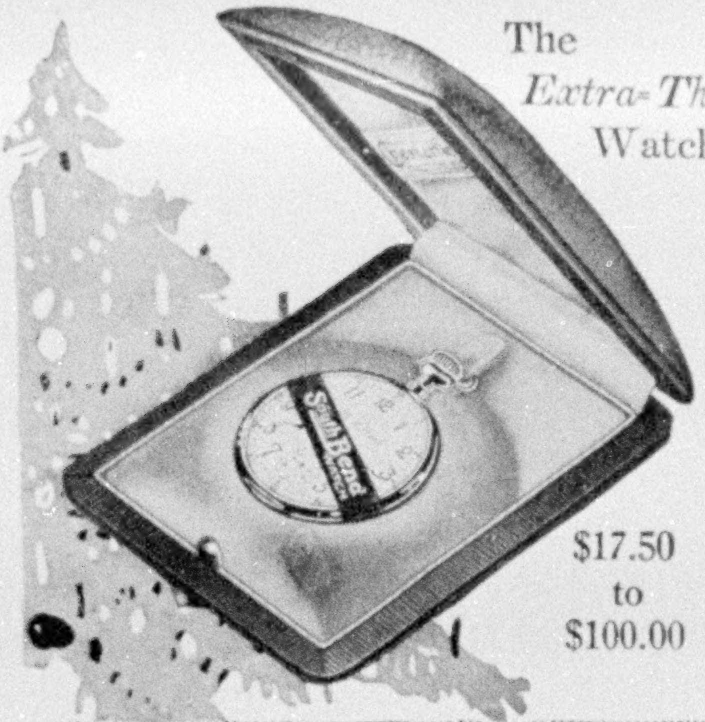

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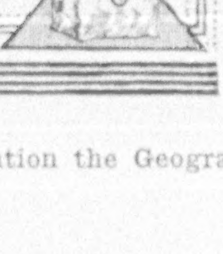

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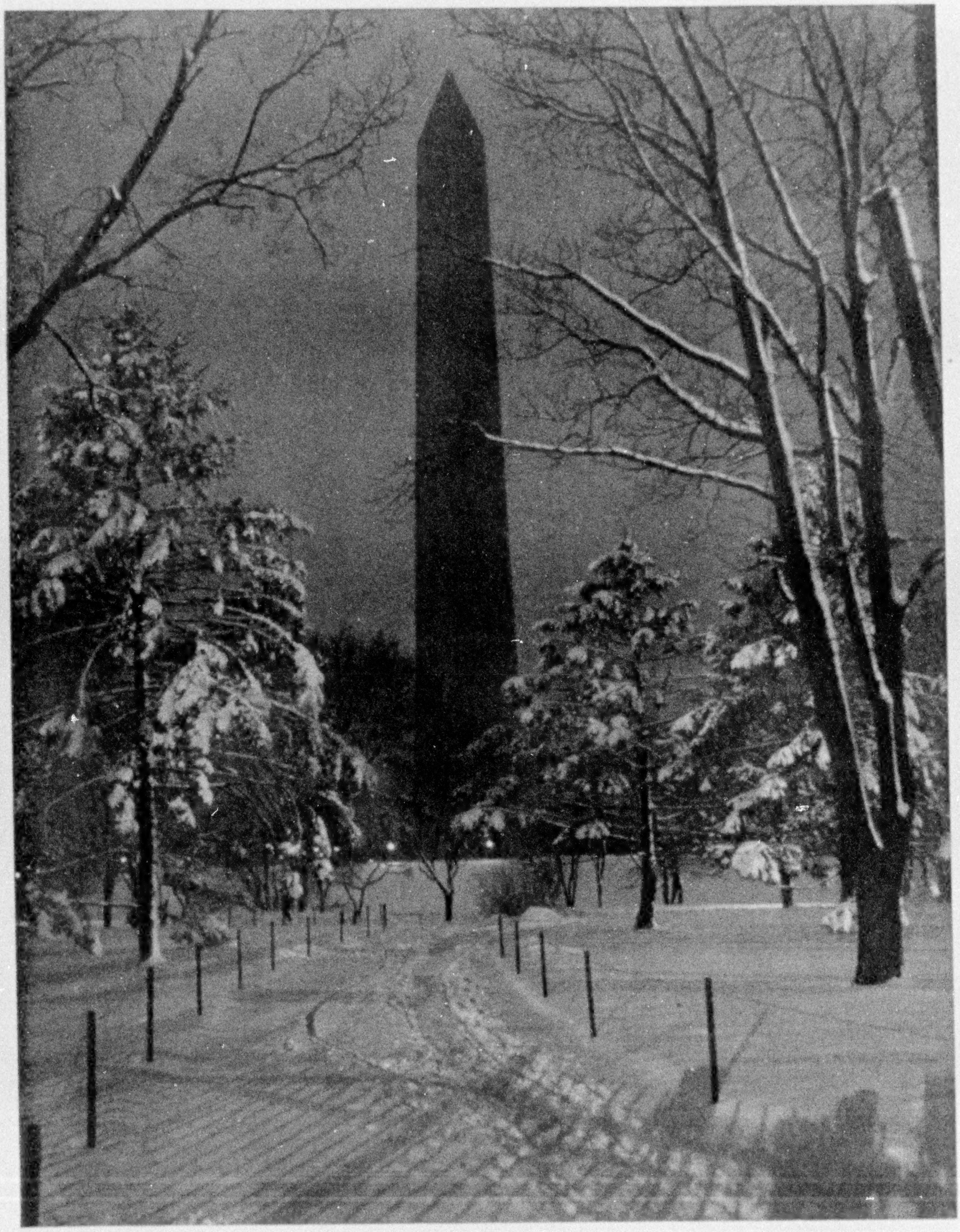

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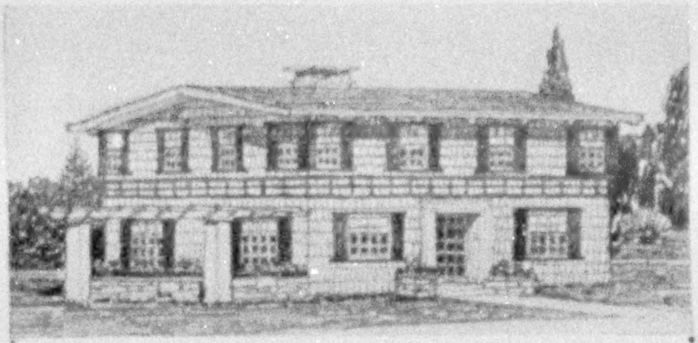

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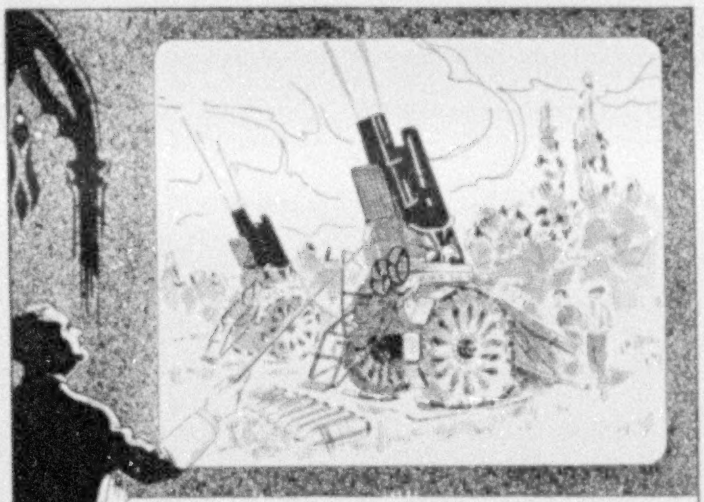

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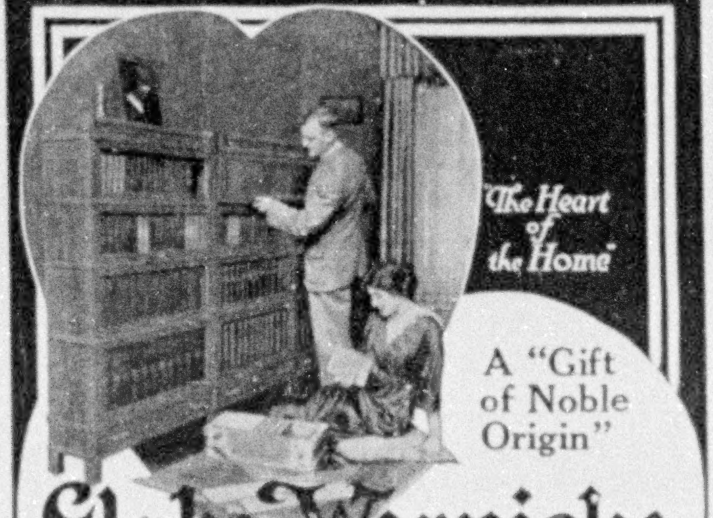

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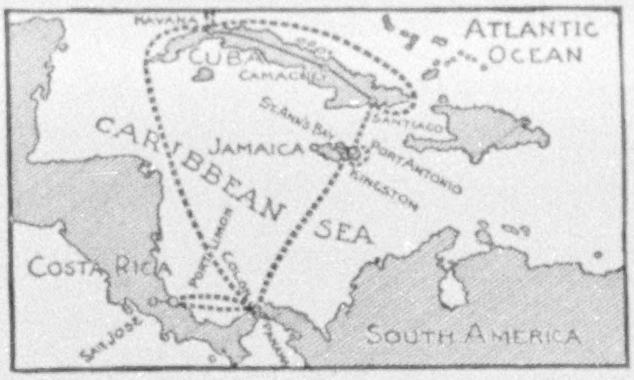

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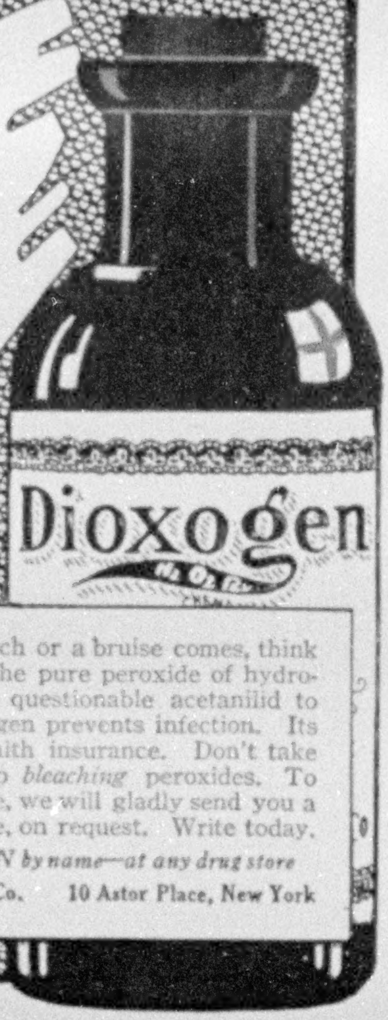

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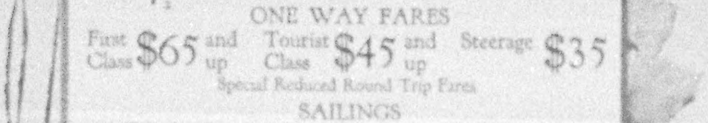

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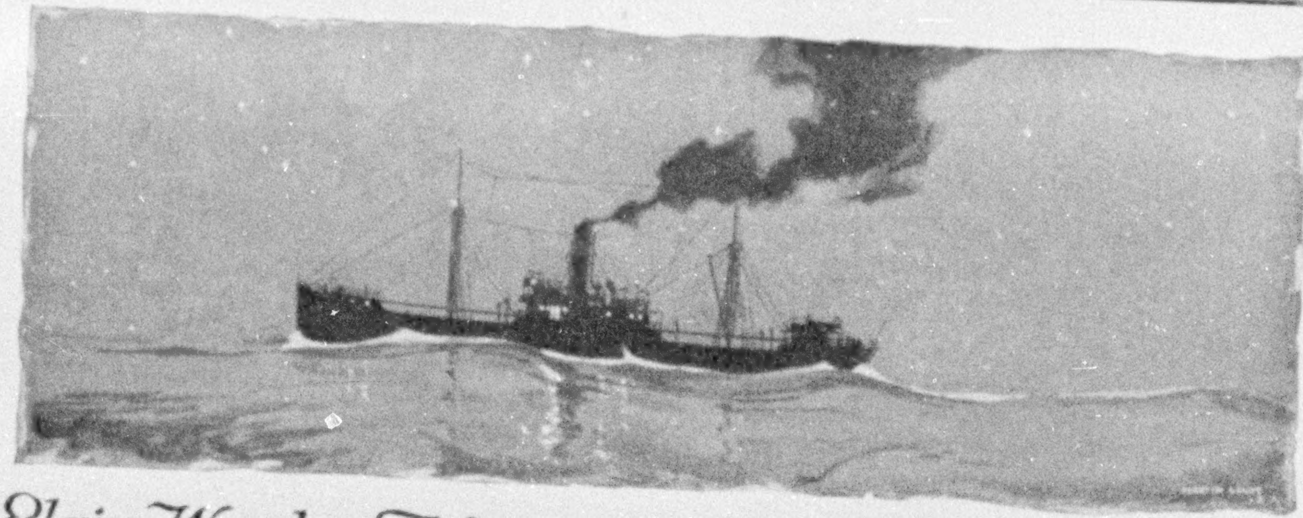

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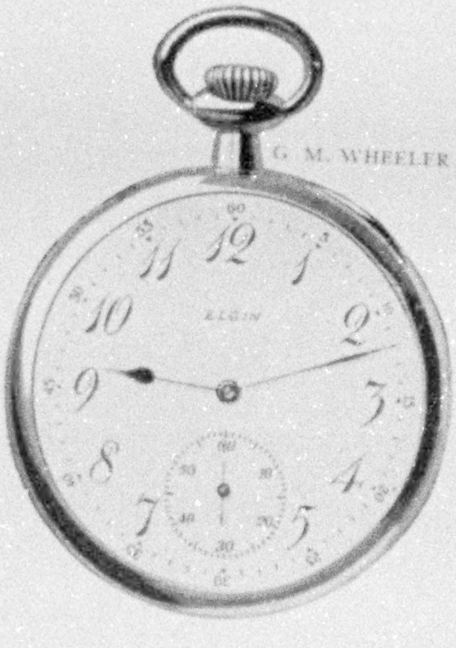

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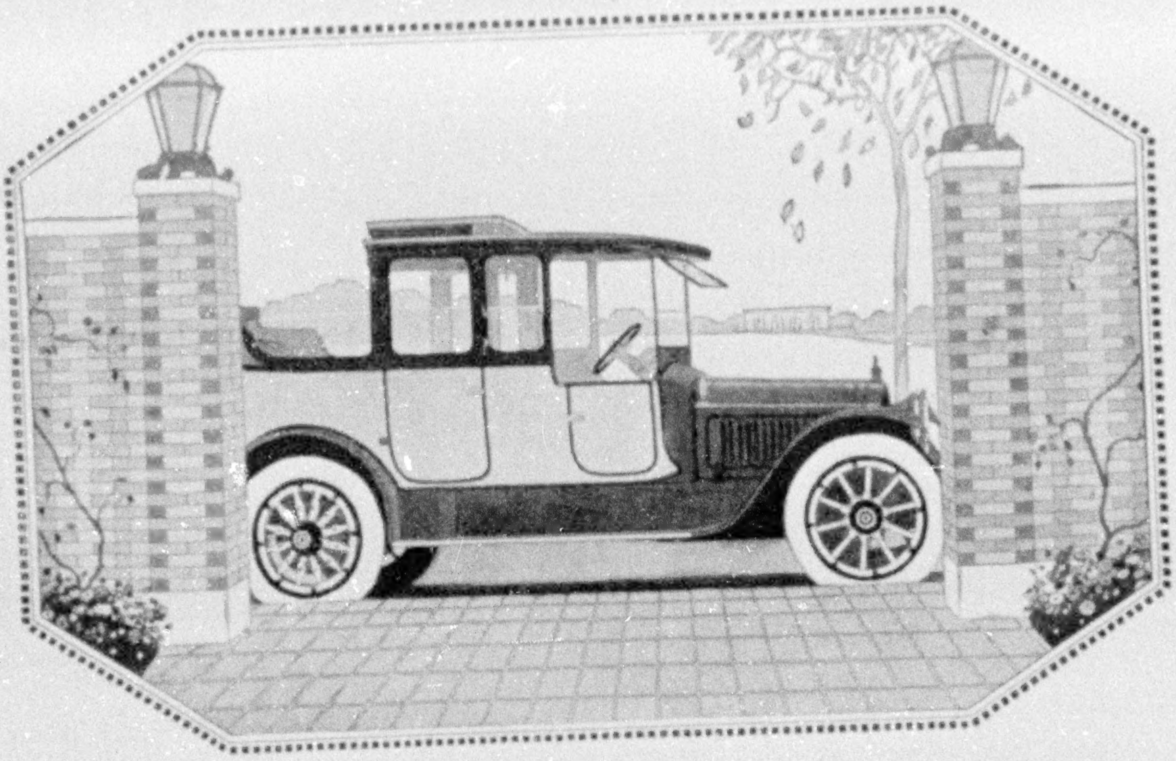

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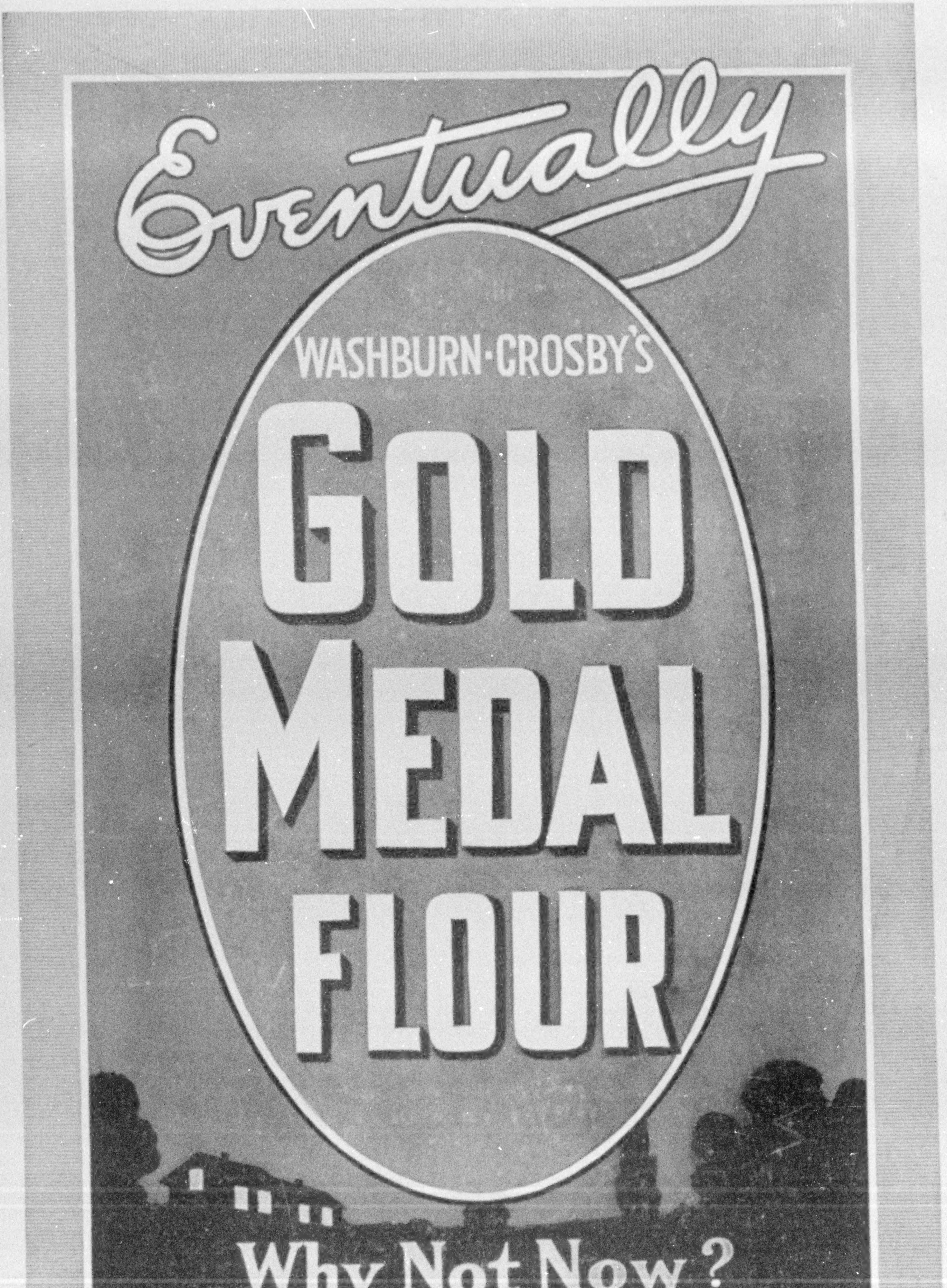

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